

LIBA Oksana

Ph.D in Pedagogy, Associate Professor, Associate Professor of the Department of Theory and Methodology of Primary Education, Mukachevo State University

INNOVATIVE TECHNOLOGICAL PORTFOLIO AS A MEANS OF DEVELOPING PRIMARY SCHOOL PRE-SERVICE TEACHERS' MOTIVATION FOR TEACHING MATHEMATICS.

Summary. The implementation of the mathematics education branch within the framework of the New Ukrainian School requires training teachers capable of transforming complex abstract material into engaging, child-centered activities. This updates the problem of forming positive intrinsic motivation among future educators to teach mathematics, as traditional reproductive methods often trigger psychological barriers in students.

The article aims to theoretically justify and reveal the effectiveness of using an innovative technological portfolio as an efficient means of shaping the professional motivation of future primary school teachers to teach mathematics.

The study utilized a comprehensive set of theoretical methods: analysis of psychological, pedagogical, scientific, and methodological literature alongside regulatory documents. The author's definition of the "innovative technological portfolio" of a future primary school teacher for teaching mathematics is formulated. Four basic pedagogical conditions for the effective implementation of the technological portfolio into the educational process of higher education institutions are identified and characterized in detail: the professional-didactic orientation of tasks, the integration of digital tools and cloud technologies, the introduction of reflective-binary assessment, and the provision of a practice-oriented connection with potential employers.

The novelty of the research lies in the development and presentation of an approximate structure for the

"Mathematical and Methodological Cluster" of the e-portfolio, constructed in accordance with the content lines of the Typical Educational Program of the New Ukrainian School ("Numbers, operations with numbers. Quantities", "Geometric shapes", "Mathematical expressions. Equalities. Inequalities. Equations", "Mathematical problems and investigations", "Data processing"). It is proven that the use of such digital tools as GeoGebra, LearningApps, Canva, Padlet, and Genially significantly increases students' technological confidence. A step-by-step action algorithm for higher education lecturers on implementing this technology is proposed, covering organizational and technological launch, learning contracting, mentoring, the mutual peer-review mechanism, and open presentations of results to stakeholders.

The practical value of the results lies in the possibility of their direct implementation into the educational process of pedagogical universities to form a stable intrinsic motivation in future specialists.

Keywords: innovative technological portfolio; mathematical competence; professional motivation; future primary school teachers; New Ukrainian School.

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 <https://orcid.org/0000-0001-5387-1115>

MIKAELIAN Hamlet

Doctor Science of Pedagogy, Ph.D in Physics and Mathematics, professor,
Professor at the Department of Mathematics and its Teaching Methods,
Khachatur Abovyan Armenian State Pedagogical University,

 h.s.mikaelian@gmail.com

 <https://orcid.org/0009-0009-4059-6447>

MIKAELIAN Ani

Teaching associate of Akian College of Science and Engineering,
American University of Armenia

 animikaeliann@gmail.com

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UNIFYING CRITERIA OF SCIENTIFIC BEAUTY AS A SOURCE OF CREATIVITY IN THE CONTEXT OF MATHEMATICS EDUCATION

Abstract. This article examines the possible influence of beauty on students' creative activity in the context of mathematics teaching. The unifying criteria of scientific beauty are considered as criteria for mathematical beauty: uniting of diversity, universality, the mathematical notation of scientific regularities, and applicability. It is shown that each of these criteria, in its own way, contributes to the manifestation and activation of students' creative abilities. Mathematical concepts, judgments, and conclusions are considered the objects of students' creative activity.

The problem is considered both in the context of school mathematics and in its practical application. The unity of manifolds and commonality as aesthetic characteristics are manifested in all the main objects of school mathematics. Such

manifestations allow for a fresh look at these objects from the perspective of their origin and interrelationships, engaging them in the sphere of student creative activity, and enriching the system of school mathematical exercises with new quantitative and qualitative aspects. The criterion of the mathematical notation of scientific regularities manifests itself both in the applied environment and in the form of purely mathematical formulations. The manifestations of this characteristic in applied settings offer broad, but not profound, opportunities for creative work. At the same time, similar manifestations in mathematics can facilitate the realization of full-fledged creative activity, satisfying all levels of complexity – from proof problems to the discovery and proof of theorems. However, implementing the latter observation presents a

serious methodological challenge and requires a special approach.

Each of the criteria considered as a source of creative activity is illustrated in the paper with practical examples from textbooks. These examples have both quantitative and qualitative dimension

Keywords: *Aesthetic criteria of mathematics unity in diversity; universality; applicability; Creativity in school mathematics; Mathematical task design*

Problem Statement. The role of mathematics and its teaching in stimulating students' creativity is well known. This activity is typically associated with the exceptional importance of mathematics in revealing and establishing truth. However, an important source of creativity can be not only truth but also beauty, with which mathematics is also closely linked, which is more clearly manifested in the criteria of scientific or mathematical beauty. In this case, a natural question arises: does beauty in mathematics become a source of stimulating students' creative activity? This question is illustrated by an example of the unifying criteria of mathematical beauty. It should be noted that the creativity that arises here has not only quantitative but also qualitative dimensions.

The goal of the work is to study the influence of the unifying criteria of scientific beauty on increasing the creative activity of students in the process of learning mathematics.

Research Analysis. The intersection of creativity and beauty is widely recognized within educational research. Beauty is perceived as one of the main factors stimulating creative activity, and beauty and creativity are considered the initial and final links in the chain of development of human ingenuity (Torosyan, 2021):

Beauty → Contemplation → Observation →
Creativity

L. Robertson (2016, p. 3), believes that "creativity strives for beauty". The important role of mathematics and its teaching in developing students' creative abilities is also widely acknowledged. This role is generally attributed to the exceptional significance of mathematics in the process of discovering and establishing truths (Silver, 1997; Leikin, 2017; Chamberlin, Liljedahl, Savić, 2023). At the same time, mathematical creativity has always been associated with beauty.

Moreover, as J. von Neumann (1947, p 180–196) notes, "the development of mathematics is primarily associated also with aesthetic motives"

The question of the beauty of mathematics has been considered since ancient times, but the first scientific study in this area was conducted only in the 18th century by the Scottish philosopher F. Hutcheson (Hutcheson, 2004). Both Hutcheson and many of his followers proposed certain criteria, any one of which, if satisfied, would make a scientific or mathematical object considered beautiful (Hutcheson, 2004, Mikaelian, 2019). It has been found that many objects observed both in mathematics and in the process of its teaching fully meet many of these criteria and, therefore, become beautiful (Mikaelian, 2019).

In H. Mikaelian (2019), the diversity of these criteria of scientific or mathematical beauty is classified according to their objective and subjective natures. Each of these two groups is, in turn, divided into three subgroups. The influence of these various subgroups of aesthetic criteria on the process of activating students' creative activity has been examined in several of the author's works. In this article, the aesthetic criterion of simplicity is considered by the authors to be a source of creativity¹, while in H. Mikaelian this source is the logical criteria of mathematical beauty: parity, logical rigor, and the reduction of the complex to the simple².

Considering creativity in the context of digitalization of mathematical education, H. Mikaelian comes to the conclusion that the cognitive attributes of subjective criteria of scientific beauty serve as an aesthetic source of creativity: intellectual search, discovery, identification and cognition of non-obvious truth³. Autor examines the problem for a subgroup of unifying attributes of the objective criteria of scientific beauty. The unification of things, phenomena, people, societies, etc. is organized on the basis of the commonality of certain (some) properties and can have both positive and negative significance.

However, in mathematics (as in science in general), only the positive effect of a given phenomenon is considered, meaning that all resulting unifications are considered beautiful (Mikaelian, 2019). Such unifying aesthetic features include unity of diversity, univer-

¹ Mikaelian, H.S., Mikaelian, A.V. (2026). The aesthetic principle of simplicity is a source of creativity in the context of mathematical education. *Proceedings of the VI All-scientific and practical conference*. Pp. 206–210.

² Mikaelian, H.S. (2026). Logical criteria of scientific beauty as a source of creativity in the context of mathematics education. *Philosophy of Mathematics Education Journal*, University of Exeter, UK. *In print*.

³ Mikaelian, H.S. (2026). Cognitive criteria of scientific beauty as a source of creativity in the context of computerization of mathematical education. *X International Scientific Conference of education and methodology of e-learning: digital technologies in education*. October 13–16. *In print*.

salinity, mathematical notation of a scientific pattern, and applicability of a mathematical object (Mikaelian, 2019). The unifying criteria of mathematical beauty are manifested at all levels of general education, and not only in the teaching of mathematics (Mikaelian, 2025). They also serve as an important source of creativity and the development of students' creative abilities. However, teachers usually ignore them, depriving or separating students not only from interaction with beauty, recognizing beauty, and living in harmony with beauty, but also from an important source of creativity and the expression and development of creative abilities. The subgroup of unifying features includes unity of diversity, universality, mathematical notation of scientific regularity, and applicability (Mikaelian, 2019). The first two of these features were proposed by F. Hutcheson (Hutcheson, 2004). The third by V. Volkenstein (Volkenstein, 1931). These features are also considered in this work as sources for the development of students' creative activity.

Presentation of the main material.

1) Unity in diversity. Unity in diversity is the first criterion proposed by F. Hutcheson as a general aesthetic principle for evaluating the beauty in nature and science (Hutcheson, 2004). The aesthetic principle of unity in diversity is also widely manifested in all objects of school mathematics: concepts, judgments, conclusions: each concept, axiom; theorem can be considered as a unity in manifolds (Mikaelian, 2019). The criterion of unity in diversity can also serve as an important source of creativity, the development of students' creative abilities. Students' creative activity can develop through the teaching of each of the aforementioned objects of school mathematics.

We begin with concepts and consider arithmetic examples.

In response to the questions "What is 1, 2, 3?", elementary school students point to an object or set containing one, two, or three elements, respectively, without paying attention to the nature of the objects. This means they are close to understanding that 1 unites objects or sets containing one element, 2 unites two elements, and so on. That is, the union of manifolds is part of the nature of natural numbers. Clearly, the creative side of finding answers to the above questions is small and easily implemented.

In recent works, H. Mikaelyan proposes to consider ways to develop students' creative activity through teaching them how to write natural numbers. The situation becomes more complex when defining and writing fractions or rational numbers. Teaching this concept typically begins with a problem arising in a

practical setting. Examples of halves, quarters, and other well-known parts of various objects are given. Here, the need arises to create and represent a new number using two natural numbers, m and n . How do we name and write the quantity of an object obtained by combining n parts of an object divided into m equal parts? In Armenian, this number is called a fraction (from the word "divide"). The number of divided parts is called the denominator (from the word "declare"), and the number of parts taken is called the numerator (from the word "count").

A creative approach requires considering the appropriateness of each of these terms, their choice, and possible suggestions from students, after which the next question is discussed: how to represent this quantity or number. An important example of creative work, albeit ineffective, but developing the creative abilities of students, can be the formulation of a question about the recording of fractions, revealing historical approaches to this process, which students will be asked to apply in practice. The applied environment of mathematics plays an important role in representing arithmetic operations as a unity in diversity. This role varies for different operations. Key operations are addition and multiplication, which cannot be precisely defined in the school curriculum and are characterized by applied environment models as a unity of manifolds.

Other operations are already understood thanks to these two, although they are also represented in the applied environment by their models as a unity of manifolds. A good knowledge of both numbers and operational models is an important prerequisite for a creative approach in the case of concepts; a creative approach allows for similar comparisons to be made in algebra. Further modeling and problem solving in the applied environment.

Some card games utilize the so-called joker concept, where one card can transform into any other card. This is also an expression of the unity of manifolds, and the unknown in algebra is nothing more than a joker, which can transform into any number. And algebra is arithmetic with jokers. And just as the presence of jokers makes a card game more interesting and requires greater creative effort from the player, the presence of a variable increases the opportunity to demonstrate creativity.

One important manifestation of unity in diversity in school algebra is the identification of the fundamental objects of algebra – algebraic expressions – which is accomplished in two ways, creating different opportunities for creative work: equality and identity. The

identification of these methods is also an example of the unity of varieties, and the corresponding proof requires serious creative work, which is difficult for secondary school students to accomplish. Typically, this proof is based on the concepts of polynomials and algebraic fractions and is not included in school textbooks. The question of the difference between these two methods, equality and identity, remains unknown to students. H. Mikaelian (2023, 2024, 2025) textbooks have eliminated this omission. It should be noted that, although the concept of identity is widely used in secondary school, and a wide range of identification tasks requiring proof of identities is presented, these, while also offering ample opportunities for activating creative activity, are solved only through the application of the idea of equality and its properties.

Theorems of school mathematics are important objects of unity in diversity. As goals of creative activity, they manifest themselves in their connection with truth and applications. The connection of theorems to truth in mathematics is expressed in two components: the discovery of truth and the justification of truth. A mathematician first discovers a theorem or the truth expressed in it, after which it is formulated as a theorem, and the path of discovery becomes the justification of the theorem.

In school textbooks, the presentation scheme varies first the theorem is presented, then its proof, which is presented as its justification. Since the proof is conducted in accordance with the laws of logic, it serves as an important means of developing students' logical thinking. As we see, the creative element of discovering a theorem or the truth expressed in it is lost here. Of course, the order of components in the theorem-proof sequence in textbooks can be changed, but on the one hand, this is a methodologically relevant problem; on the other, it also raises moral and psychological difficulties (Mikaelian, 2019),

Another opportunity to express the creative potential of theorems is related to their applications. Moreover, applications can be made both in the applied environment of mathematics and in the structures of mathematical material itself and in the solutions of mathematical problems.

Mathematical methods of proof are also important objects for demonstrating the unity of manifolds. An important example of unity in diversity is induction – a method of arriving at generalized reasoning on the basis of particular facts. It opens up broad opportunities for creativity. However, inductive reasoning is not always correct,

since the presence of particular facts, even true ones, is sometimes insufficient to establish a general conclusion. In mathematical induction the situation is different: clear particular conditions are established that guarantee the validity of the general conclusion.

Mathematical induction therefore becomes an important method for discovering and establishing regularities on the basis of unity in diversity, the realization of which usually requires a creative approach. The unity of diversity is also evident in the methods used in school mathematics, such as deduction, the coordinate method, and the axiomatic method. Each of these methods opens up broad opportunities for creative activity.

Let us consider the tasks from the textbook H. Mikaelian (2025), related to the aesthetic principle of unity in diversity, the solution of which opens up wide opportunities for the manifestation of students' creative abilities. Moreover, creativity here in many cases acquires an evaluative dimension.

1. What unity in diversity does each of the following concepts express?

- | | |
|-------------|--------------|
| a) Student, | b) Boy, |
| c) Mother, | d) Soldier, |
| e) x , | f) 1, |
| g) $x-y$, | h) $x+0=x$. |

2. Is unity in diversity a positive or a negative phenomenon?

- In people's lives,
- In the Armenian language,
- In mathematics.

3. Write an essay on one of the following topics:

- Unity in diversity can be dangerous
- A theatrical performance as unity in diversity
- Our family as unity in diversity
- The classroom as unity in diversity
- School as unity in diversity
- Friendship as unity in diversity
- The army as unity in diversity
- The homeland and unity in diversity

4. Represent a mathematical object as an example of unity in diversity:

- $x+0=x$,
- $1+1=2$,
- $1 \cdot x=x$,
- $x+y=y+x$,
- If $x=y$, then $x+z=y+z$,
- If $x < y$ and $z > 0$, then $xz < yz$.
- The interval method for solving inequalities

2) Universality. Closely related to the criterion of the unity of manifolds is Hutcheson's aesthetic criterion of universality: a mathematical or scientific object that constitutes a unity of manifolds is also universal to the elements that comprise that unity. According to this criterion, the transition from the general to the particular,

from a concept to an element of its domain of application, or from a statement to its particular case or consequence, is considered beautiful. This attribute is also widely manifested both in mathematics and in its teaching (Mikaelian, 2019). The aesthetic principle of universality can also serve as an important source of creativity and the development of students' creative abilities.

Numbers, variables, operations performed with them, numerical and algebraic expressions, equalities, inequalities, and other formulas are common to the objects of the applied environment for which they serve as models. This allows for the simulation of the situation in the applied environment and the implementation of transformations using the model: simplifying, solving the model, and reinterpreting the simplified or solved form in the applied environment. This process, stemming from the aesthetic characteristic of commonality, which is the primary means of demonstrating the applied potential of mathematics, also represents a wonderful area of creativity and creative activity.

Considering the elements of logic and its individual laws from a universal perspective opens up broad opportunities for creative work. Already in middle school, teaching logical sums, products, negations, consequences, and equivalence, as well as certain related laws as manifestations of universality, can be distinguished not only by their aesthetic appeal but also by opportunities to stimulate creative activity. An important example of the principle of universality is deduction – a process of logical reasoning that allows one to derive a particular proposition from known general premises. Along with induction, it is widely used both in mathematics and in school mathematics courses, primarily requiring a creative approach from the subject. However, in school practice, the creative potential of deduction and the deductive method is typically utilized only partially, primarily in proof exercises. The primary deductive sources of creativity, theorem proofs, are introduced after the theorems have been formalized, becoming merely a means of logically substantiating the theorem. At the same time, presenting school courses in geometry and algebra as meaningful axiomatic theories creates examples of deductive reasoning of varying complexity, and the teacher has the opportunity to engage students with varying creative abilities.

Let us also consider several problems from the school mathematics curriculum, taken from the author's textbook H. Mikaelian (2025), whose universality may be explored through solution strategies that engage students in creative activity.

1. Determine the universality of the following statements:

- a) A student should be conscientious.
- b) One should respect one's elders.
- c) One should love one's country.
- d) The golden rule of moral conduct: Do unto others as you would have them do unto you.
- e) The golden rule of moral conduct: Do not do unto others as you would not have them do unto you.

2. Do you follow the golden rule of moral conduct?

3. Determine the universality of the following statements:

- a) $1 < 2$,
- b) $x+0=x$ for any expression x ,
- c) $(a+b)^2=a^2+b^2+2ab$,
- d) The area of a rectangle equals the product of its length and width.

4. Is universality a positive or a negative phenomenon?

- a) In life,
- b) In the Armenian language,
- c) In mathematics.

3) Mathematical formulation of a scientific law. According to this principle of mathematical aesthetics, proposed by V. Volkenshtein, any clear and harmonious formulation of a scientific truth in the language of mathematics produces an aesthetic impression. The need for a mathematical notation of scientific laws first arose in natural sciences. As Galileo Galilei noted, "The book of nature is written in the language of mathematics, and to read it, one must know the language of mathematics". Mathematics here serves as an important tool for discovering and formulating the laws that arise in these sciences, that is, for exploring these areas of science. These mathematical formulations of scientific laws also possess other attributes of mathematical beauty: unity of manifolds, universality, simplicity, clarity, logical rigor, unexpectedness, knowledge of non-obvious truth, etc., which imparts exceptional aesthetic appeal to this process (Mikaelian, 2019).

The best example of creative application of mathematical knowledge received at school was a case involving one of the authors, who went to buy a cow in a neighboring village. Before this, his biology teacher had shown him a mathematical formula for determining milk yield in a cow depending on the size of different parts of the body and comparing the obtained values. His attempts to apply it gave a positive result only with the third cow he bought. And his mother told the neighbors with pride for a long time about the role of her son's mathematical knowledge in choosing this dairy cow.

The courses in natural academic subject disciplines in general education schools

contain various examples of mathematical notation of the laws of the relevant sciences, the derivation of which and the solution of problems associated with them are important areas for activating the creative activity of students. The writings of mathematical patterns are also beautiful, the aesthetic appeal of which becomes more pronounced when their perception and assimilation is accompanied by creative activity. Let us consider an example.

In the middle school mathematics curriculum, students are taught the rule for multiplying fractions: when multiplying two fractions, the numerators are multiplied together and the denominators are multiplied together. A student can readily perform the operation $\frac{1}{2} \cdot \frac{1}{3}$, obtain $\frac{1}{6}$, and justify the result by referring to this rule. However, when asked to explain why the rule works – why the numerators are multiplied with one another and the denominators with one another – the student often becomes confused.

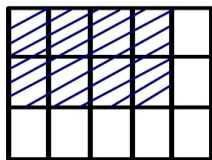


Fig. 1

On the one hand, the student knows the rule, or its mathematical formulation, $a/b \cdot c/d = ac/bd$. On the other hand, this knowledge is merely formal or procedural: it has not been fully understood. As a result, its aesthetic appeal is limited. To achieve a deeper sense of attractiveness and understanding, a creative approach is required, which can be implemented in two ways.

The first way is to provide a proof.

We have

$$\left(\frac{a}{b} \cdot \frac{c}{d}\right) \cdot bd = \left(\frac{a}{b} \cdot b\right) \cdot \left(\frac{c}{d} \cdot d\right) = ac.$$

Therefore,

$$\frac{a}{b} \cdot \frac{c}{d} = \frac{ac}{bd}$$

the second way is to use a typical application-based example (fig. 1). For instance, why is

$$\frac{2}{3} \cdot \frac{4}{5} = \frac{8}{15} = \frac{2 \cdot 4}{3 \cdot 5}.$$

As a creative assignment, the teacher may ask students to provide multiple justifications for the multiplication of other (including improper) fractions, as well as their proofs, using the reasoning scheme presented above.

4). Applicability. Above, we noted the important role of mathematics in the study of nature and the natural sciences. The same applies to many fields within the humanities and the arts. These broad possibilities of application of mathematics also determine the beauty of its objects: the applicability of mathematical objects is considered an

aesthetic criterion, and the aesthetic appeal of such an object is also determined by its applicability. Many topics in the school mathematics curriculum likewise possess wide-ranging applications.

In the mathematics curriculum of general education schools, alongside purely theoretical material, applied contexts occupy an important place. These include problems drawn from everyday life as well as from related academic disciplines, which are modeled and solved using mathematical tools.

The diversity of these applied contexts and modeled situations creates broad opportunities for creativity and for the development of students' creative abilities. Let us consider some typical examples.

Uniform motion.

Situation 1

Two cars start simultaneously from two points at distances s apart and move toward each other with speeds v_1 and v_2 . They meet after time t .

a) Model the situation: $t(v_1 + v_2) = s$.

b) There are four variables and one equation; therefore, any one of the variables may be treated as unknown while the other three are given. Depending on the choice of the unknown, four types of problems arise.

c) Formulating these problems involves creative elements; the teacher may discuss this with students and guide them in producing the different variants.

Situation 2

a) The teacher provides the model:

$$t(v_1 + v_2) + s' = s.$$

b) Restore the real-world situation represented by the model.

c) Treat each of the five variables as unknown in turn and formulate five corresponding problems.

The requirements in items b) and c) below are analogous to those in Situation 2.

Situation 3

a) Model: $t(v_1 + v_2) + s' = s$ or $t(v_1 + v_2) - s' = s$.

Situation 4

a) Model: $t(v_1 + v_2) + t'v_1 = s$.

Situation 5

a) Model: $t(v_1 + v_2) + t'v_2 = s$.

Situation 6

a) Model: $t(v_1 + v_2) + t'v_2 = s$ or $t(v_1 + v_2) - t'v_2 = s$.

Additional situations may also be considered, assuming that the cars move

a) in the same direction;

b) in different directions, but not directly toward one another.

The path of motion may also be modified – for example, made circular – while the direction of motion may remain the same or be opposite. It is likewise possible to consider the case of uniform motion of a cart, where an appropriate model establishes the relation-

ship between the distance traveled and the number of wheel revolutions.

Filling and emptying a pool.

Situation 1

A pool with capacity s is filled simultaneously by two pipes with rates v_1 and v_2 . After time t , the pool is full.

a) Model: $t(v_1 + v_2) = s$

b–c) Use the same requirements as in the motion section: vary the unknown, formulate different problem types, and explain the modeled situation.

Situation 2. Model: $t(v_1 - v_2) = s$.

Situation 3. Model: $t(v_1 + v_2) + s' = s$.

Situation 4. Model: $t(v_1 - v_2) + s' = s$.

Situation 5. Model: $t(v_1 + v_2) + t'v_1 = s$.

Situation 6. Model: $t(v_1 + v_2) + t'v_1 + s' = s$.

Requirements (for each model):

a) Restore the real-world situation.

b) Formulate problems by treating each variable as unknown in turn.

Mixtures.

Situation 1

Two brines with masses m_1 and m_2 , containing $p_1\%$ and $p_2\%$ salt respectively, are mixed to obtain a mixture containing $p\%$ salt.

Situation 2

Two mixtures with masses m_1 and m_2 , containing $p_1\%$ and $p_2\%$ gold respectively, are mixed to obtain a mixture containing $p\%$ gold.

Situation 3

Two containers of water with masses m_1 and m_2 and temperatures t_1 and t_2 , respectively, are mixed to obtain a mixture with temperature t .

Requirements.

a) Model Situations 1–3. For example:

$$m_1 p_1 + m_2 p_2 = (m_1 + m_2) p$$

b) Formulate a problem by taking each of the variables as the unknown in turn.

Conclusions. Both in nature and art, as well as in mathematics and its teaching, beauty, acting as a unifying criterion for mathematical beauty, is a source of creativity and the development of students' creative abilities. Different unifying criteria fulfill this role differently in different elements of the school mathematics curriculum.

The unity of diversity and universality as aesthetic characteristics are manifested in the fundamental objects of school mathematics: concepts, theorems, and proof methods. Such manifestations allow us to look at these objects in a new way, from the perspective of their origins and interrelations, to involve a creative element in the learning process, and to imbue mathematical exercises with both quantitative and qualitative aspects.

The criterion of mathematical notation of scientific regularities manifests itself both in the applied environment and in the form of

school mathematical statements. The manifestations of this criterion in an applied environment offer broad, but not profound, opportunities for creative work. At the same time, in mathematics such manifestations can facilitate the implementation of a full-fledged creative activity that satisfies all levels of complexity, from proof problems to the implementation of the discovery function in theorem proving. However, implementing the latter observation presents a serious, methodical challenge and requires a special approach.

The aesthetic principle of applicability also manifests itself in school mathematics and its applied environment. Problems involving modeling motion, collaborative works, mixtures, alloys, and other situations in an applied environment offer exceptional opportunities for creative work.

Implications for Further research. The research conducted can be supplemented by studying the relationship between other characteristics of scientific criteria, as well as the internal and external aesthetics of mathematics

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МІКАЄЛЯН Гамлет

доктор педагогічних наук, кандидат фізико-математичних наук, професор,
професор катедри математики та методики її навчання,
Вірменський державний педагогічний університет імені Хачатура Абовяна,

МІКАЄЛЯН Ані

викладачка коледжу науки та техніки Акіяна,
Американський університет Вірменії

ОБ'ЄДНУВАЛЬНІ КРИТЕРІЇ НАУКОВОЇ КРАСИ ЯК ДЖЕРЕЛА КРЕАТИВНОСТІ У КОНТЕКСТІ МАТЕМАТИЧНОЇ ОСВІТИ

Анотація. У статті розглядається можливий вплив краси на творчу діяльність учнів у контексті викладання математики. Як критерії математичної краси розглядаються об'єднуючі критерії наукової краси: об'єднання різноманітності, універсальності, математичного запису наукових закономірностей та застосовності.

Показано, що кожен із цих критеріїв по-своєму сприяє прояву та активізації творчих здібностей учнів. Математичні поняття, судження та висновки розглядаються як об'єкти творчої діяльності учнів.

Проблема розглядається як у контексті шкільної математики, так і в її практичному застосуванні. Єдність різноманітності та спільності як естетичні характеристики виявляються в усіх основних об'єктах шкільної математики. Такі прояви дозволяють по-новому поглянути на ці об'єкти з точки зору їх походження та взаємозв'язків, залучити їх у сферу творчої діяльності учнів, збагатити систему шкільних математичних вправ новими кількісно-якісними аспектами.

Критерії математичного запису наукових закономірностей проявляється як у прикладному середовищі, так і у вигляді суто математичних формулювань. Прояви цієї характеристики в прикладних умовах уможливають широкі, але не глибокі, можливості для творчої роботи. Водночас подібні прояви у математиці можуть сприяти реалізації повноцінної творчої діяльності, що задовольняє всі рівні складності – від задач на доведення та доведення теорем. Однак реалізація такого аспекту являє собою серйозний методологічний виклик і вимагає спеціального підходу.

Кожен із критеріїв, що розглядаються як джерело творчої активності, ілюструється у статті практичними прикладами з підручників. Ці приклади уможливають як кількісний, так і якісний вимір.

Ключові слова: естетичні критерії єдності математики в різноманітності; універсальність; застосовність; креативність у шкільній математиці; розробка математичних завдань.

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 <https://orcid.org/0000-0002-7375-1281>

ОЛІЙНИК Леонід

доктор педагогічних наук, старший науковий співробітник,
начальник науково-методичного відділу аналізу та прогнозу освітньої діяльності
науково-методичного центру організації та провадження освітньої діяльності,
Національний університет оборони України

 ol33@ukr.net

 <https://orcid.org/0000-0002-7718-3488>

САВІНА Інна

кандидатка педагогічних наук, старша викладачка катедри історії війн та воєнного мистецтва,
Національний університет оборони України

 Savina_Inna@ukr.net

 <https://orcid.org/0009-0002-6173-4959>

СВІДНІЦЬКИЙ Сергій

начальник науково-методичної лабораторії внутрішнього забезпечення якості освітньої діяльності
науково-методичного відділу аналізу та прогнозу освітньої діяльності,
Національний університет оборони України оборони України

 nw3@ukr.net

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ТРАНСФОРМАЦІЯ МОДЕЛІ ПРОФЕСІЙНОЇ ВІЙСЬКОВОЇ ОСВІТИ: КОНЦЕПТУАЛІЗАЦІЯ УКРАЇНСЬКОЇ МОДЕЛІ ОСВІТИ, ЗАСНОВАНОЇ НА БОЙОВОМУ ДОСВІДІ, ЯК АДАПТИВНОЇ ОСВІТНЬОЇ СИСТЕМИ

Проаналізовано передумови трансформації професійної військової освіти в умовах високої динаміки сучасного операційного середовища та накопичення Збройними Силами України унікального бойового досвіду.

Встановлено суперечність між необхідністю збереження нормативної впорядкованості, системності та взаємосумісності професійної військової освіти і потребою оперативного оновлення її змісту відповідно до змін характеру війни.

Визначено концептуальні засади Української моделі освіти, заснованої на бойовому досвіді – *Ukrainian Combat-Proven Education Model* – (далі – *U-CPEM*) як адаптивної освітньої системи, що інтегрує нормативно-інституційний, процедурно-освітній та емпірично-адаптивний домени.

Уточнено місце аналізу проведених дій (*After Action Review*) та процесу вивчення і впровадження досвіду (*Lessons Learned*) у трансформації бойового досвіду в структурований освітній зміст.