The Importance of Creative Imagination in the Educational Process and the Neurophysiological Foundations of Creativity

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The article examines creative imagination as the cognitive basis of creativity and considers the neurophysiological conditions that make its development possible in the educational process. Imagination is treated not as a decorative faculty but as the mechanism through which new images, concepts and projects are constructed from the material of prior experience and then subjected to critical reprocessing before they acquire objective significance. The study is based on the theoretical analysis and synthesis of psychological, neurophysiological and pedagogical sources, including the works of Rubinstein, Vygotsky, Luria, Guilford, Torrance and Timiryazev. The analysis shows that the functional asymmetry of the hemispheres determines two complementary strategies of cognitive work: the left hemisphere operates with formalised signs, numbers and logical sequences, whereas the right hemisphere organises polysemous contexts, integral images and the aesthetic perception of reality. Since the development of asymmetry depends on social influences and instruction as much as on biological maturation, the pedagogical environment can either consolidate a one-sided, left-hemisphere style of thinking or maintain the balance between logical and imaginative strategies on which creative productivity rests. The article formulates five groups of qualities that constitute creative thinking and describes the conditions under which creative imagination develops in learners: the enrichment of experience, the support of interest, the alternation of imaginative and critical work, and the materialisation of the imagined result in a product.

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1 Introduction

The current state of every field of knowledge requires a reconsideration of the principal goals and objectives of modern pedagogy. Contemporary society expects a person to apply a broad range of abilities and to develop individual qualities rather than to reproduce a fixed body of information. Among the goals of education, the preparation of the younger generation for creative labour occupies one of the most important places, and this goal cannot be achieved by adding separate courses on creativity to an otherwise reproductive curriculum. Creative capacity is rooted in imagination, that is, in the ability of the mind to construct images and concepts that are not present in immediate

perception or in the subject's past experience. For this reason, the question of how imagination develops, and of what conditions support or suppress it, is a pedagogical question of the first order.

The results of the creative process manifest themselves only when imagination has been processed cognitively and given an effective form through creative imagination. In creative activity every stage matters for the ordering of imagination through cognitive models and for leading it to a result of objective significance. Developing creative imagination also meets a fundamental requirement of education: as a planned, purposeful and pedagogically grounded process, it organically combines mental and physical labour instead of opposing them. The creativity of imagination depends directly on the richness and diversity of a person's prior experience, since this experience supplies the material from which fantasy constructions are built. The richer the experience, the more material imagination has at its disposal; the poorer the experience, the more the imagination is forced to circulate among borrowed and stereotyped forms.

The neurophysiological foundations of creativity are therefore relevant to pedagogy, because they explain why certain educational environments widen the space of imaginative work while others narrow it. Research on the functional asymmetry of the cerebral hemispheres has established that the two hemispheres implement complementary cognitive strategies, and that the dominance of one of them is shaped not only by biological maturation but also by upbringing and instruction. If the school environment systematically rewards formal-logical operations and treats imaginative work as an accessory, it consolidates a one-sided style of thinking and restricts the cognitive resources on which creative activity depends. The purpose of this article is to substantiate this claim theoretically and to derive from it the conditions under which creative imagination can be developed in the educational process. The study addressed three tasks.

2 Materials and methods

2.1 Sources and procedure of the analysis

To characterise creative imagination as the cognitive basis of creativity and to distinguish it from reproductive imagination. To analyse the neurophysiological foundations of creative activity, primarily the functional asymmetry of the hemispheres, in their pedagogical implications. To describe the structure of creative thinking and the conditions of its development in the educational process. The study employed theoretical analysis and synthesis of psychological, neuro-

physiological and pedagogical literature. The sources fall into three groups. The first comprises the general psychological theory of imagination and activity, represented above all by the works of Rubinstein, who described the tendency of the mind to pose the question of what should be changed and improved in the course of activity, and by the classical general psychology of Bogoslovsky and his co-authors [1, 2]. The second group comprises neurophysiological research on the functional asymmetry of the hemispheres and on the organisation of higher mental functions [5, 6]. The third group comprises the psychology of creativity, including the divergent-production constructs of Guilford and their operationalisation by Torrance, together with the later accounts of the creative process and of the conditions that sustain it [7, 8].

The analysis proceeded in three steps. At the first step the construct of creative imagination was defined and separated from adjacent constructs, in particular from reproductive imagination and from daydreaming. At the second step the neurophysiological material was reviewed with a single question in mind: which cognitive operations does each hemisphere support, and what does the distribution of these operations imply for the organisation of learning? At the third step the results of the first two steps were synthesised into a description of the structure of creative thinking and of the pedagogical conditions that follow from it. The study is theoretical in design; it does not report an empirical experiment, and its conclusions are therefore offered as a framework for pedagogical design rather than as measured effects. This limitation is stated deliberately, since the literature on imagination contains many normative claims that have not been tested in classroom settings.

2.2 Conceptual framework

Imagination is understood here as a cognitive process connected with reality, which takes shape through fantasy constructions and often produces a concept or an object that is absent from the subject's personal experience and does not fully correspond to existing real objects. As a result of cognitive and creative work, such imagination serves the subject as a source of innovative knowledge and models. If the imagined construction is embodied in the external environment in material or visual form, that is, if it crystallises, it becomes an object in operation, acquires real existence in the world and begins to influence other objects and processes. Creative imagination thus turns into reality through the result of activity, integrating subjective ideas into objective reality. This transition from an inner image to an external product is the criterion that separates creative imagination from fantasy that never leaves the inner sphere.

The second element of the framework is the requirement of critical reprocessing. The creative process consists of a series of interrelated stages, each of which directly affects the effectiveness of the final result; if the work at one stage is performed poorly or left incomplete, the outcome of the whole process suffers. Even the richest imagination, if it does not pass through the stage of critical reprocessing, remains deprived of social and practical significance. Critical reprocessing makes it possible to analyse the objective and the subjective aspects of an imagined construction, to discard what is merely idiosyncratic and to develop the concepts and images that can be communicated to others. In this sense imagination and criticism are not adversaries but consecutive phases of a single act of thought, and an education that cultivates one without the other produces either sterile fantasy or sterile correctness.



Figure 1 From experience to a socially significant product: the cycle of creative imagination Compiled by the author.

3 Results

3.1 Functional asymmetry of the hemispheres

The analysis of the neurophysiological literature confirms that the hemispheres implement different and complementary strategies of cognitive work. The left hemisphere fully preserves the capacity for verbal communication and for manipulating strictly formalised signs. Its activity enables a person to understand speech addressed to them, both oral and written, and to respond in a grammatically correct way; it also allows free work with numbers and mathematical formulas within the bounds of formal logic and previously mastered rules. At the same time, the activity of the left hemisphere does not help in distinguishing speech intonations and voice modulations. It is relatively indifferent to music and performs poorly at recognising complex images that cannot be decomposed into simple constituent elements; the left hemisphere alone does not make it possible to identify pictures of human faces, nor does it provide the aesthetic perception of works of art.

Innate and acquired visual generalisations are manifested in the right hemisphere, and visual perception forms the basis of object-bound thinking. The activity of the right hemisphere is connected mainly with reliance on events that occurred in the past, whereas the left hemisphere is oriented toward the future. The right hemisphere is regarded as the carrier of a person's unconscious creative potentials. Thanks to the right hemisphere the image of the world forms as a whole at once, while the left hemisphere gradually and painstakingly assembles a model of the world from separate, though carefully studied, details. The capacity to hold a great number of connections and the key role of the right hemisphere in organising a polysemous context do not diminish the role of left-hemisphere thinking in creative activity: a construction that cannot be analysed and verified remains a private fantasy, and a verification that has nothing to verify produces nothing new.

3.2 Stages of the creative process and critical reprocessing

The creative process unfolds as a sequence of stages whose interdependence explains why partial failures produce total ones. The accumulation of experience and the emergence of an interest supply the material and the impulse; imagination recombines this material into a construction that has no direct counterpart in experience; critical reprocessing tests the construction against logic, against the properties of real objects and against the requirements of the task; and the materialisation of the result in a product, model or text exposes it to the judgement of others. A weakness at the stage of experience leaves imagination without material, a weakness at the stage of criticism leaves it without direction, and a weakness at the stage of materialisation leaves it without consequences. This is why the development of creative imagination cannot be reduced to exercises in divergent thinking alone.

The classical formulation of this requirement belongs to Timiryazev, according to whom the formation of genuine talent requires the harmony of two fundamental cognitive-emotional qualities: a high degree of productivity and generativity of imagination, and the capacity for exceptionally subtle and quick critical thinking [4]. In other words, in order to display great creative potential, a person must, alongside creating new concepts and images through imagination, possess the ability to analyse and develop them critically. This formulation is important pedagogically because it locates creativity in the combination of two teachable capacities rather than in a mysterious gift, and because it implies that the two capacities must be cultivated together, in the same tasks, rather than in separate subjects.

3.3 The structure of creative thinking

The development of creative thinking presupposes knowledge of the laws to which it is subject and which determine its formation. Its basis is the formation of a number of qualities in the human psyche, which can be divided into five groups, each with its own distinctive character and, at the same time, closely interconnected in thinking activity. The first group comprises the qualities of working with images: the ability to see an object in motion and in interaction with other objects, to understand the character of dynamics and to operate with dynamic representations. The second group comprises the qualities of working with technological images: the ability to direct activity meaningfully in any environment, including new conditions, to envision the complex of events that takes place in the production, processing and transformation of an object, to compare variants and to choose the most rational and productive method of work.

Group of qualities	Content	Pedagogical implication
Working with images	Seeing an object in motion and interaction; operating with dynamic representations	Tasks with changing states, processes and simulations
Working with technological images	Envisioning sequences of operations; comparing and selecting rational variants	Design and technological projects with alternative solutions
Emotional-creative capacities	Readiness to solve creative tasks; confidence in the necessity of search	Tasks with uncertainty and a legitimate right to error
Thinking activity	High level of basic thought operations; heuristic methods and techniques	Reflective analysis of the methods used, not only of results
Creative imagination	Combination of fantasy and thinking; change of dynamic stereotypes	Open-ended problems with a materialised product

Table 1 Groups of qualities that constitute creative thinking and their pedagogical implications

Compiled by the author on the basis of the analysed psychological and pedagogical literature. The third group comprises the emotional-creative capacities that affect the intensity of creative thinking. The productivity of thinking is expressed in an orientation toward activity, in the readiness and aspiration to solve creative tasks and in confidence in the necessity of seeking new methods of activity. The fourth group comprises the qualities of the development of the individual's own thinking activity: a high general level of thinking activity, expressed in the basic processes, methods and operations of thinking, in intellectual virtues, in the ability to combine knowledge, skills and abilities in

various ways and in the use of special heuristic methods in the process of seeking, formulating and solving new tasks. The fifth group comprises the qualities of creative imagination proper: a high degree of its development, the combination of fantasy and thinking activity in solving tasks, the capacity of the personality to change its dynamic stereotypes and the possession of a system of stable complex response reactions.

3.4 Experience, interest and fantasy

Imagination never works with visual, auditory and other images alone; it always combines these components with muscular-motor and other components of experience. This is why the enrichment of experience is a precondition of the development of imagination rather than a substitute for it. Interest is closely connected with this process. Interest can be defined as the emotional manifestation of the need for cognition, and at the basis of the need for cognition lies the need for new information and new impressions. Interest manifests itself as an orientation toward a particular activity of special significance for the personality; its beginning is the emotional attractiveness of an object in the environment. Because interests are manifested in positive emotions, they bring a feeling of satisfaction with the results of work, make it possible to gather attention on the work easily and increase working capacity. Pavlov considered interest an activating factor of the state of the cerebral cortex, and in any learning process the more interest a learner has in studying, the more successfully the process proceeds.

In reality it is difficult for the learner to know and to try everything personally, and here fantasy comes to the rescue. Fantasy significantly enriches the learner's experience by introducing, in imaginary form, situations and domains that have never been encountered in real life. This gives rise to fundamentally new interests: with the help of imagination the learner finds themselves in situations that do not exist in reality and tries out activities that would otherwise remain inaccessible. The learner thereby obtains additional experience and knowledge in the sphere of life and profession, in the scientific and moral spheres, and determines the significance of particular objects of life. Imagination, in other words, is not only the consumer of experience but also its producer, and this is precisely why a pedagogy that relies exclusively on the direct experience of the learner underestimates the resources available to it.

4 Discussion and conclusion

4.1 The educational environment and the balance of cognitive strategies

Functional asymmetry is realised under adequate conditions of upbringing and teaching and takes shape in the course of individual development under the influence of social interaction. In the first years of life the right hemisphere is dominant; the relative dominance of the left hemisphere becomes noticeable from about the age of ten and intensifies toward the end of adolescence. The transition to the absolute dominance of left-hemisphere strategies depends not only on biological maturation but mainly on social influences and instruction. This conclusion has direct pedagogical consequences. In the educational culture of Uzbekistan, as in many other systems, the teaching and upbringing process is oriented mainly toward developing logical-analytical components of thinking. As a result, these components acquire a dominant position, and learners' thinking processes acquire a standardised, routinised character.

Two conditional conclusions follow from modern psychological research. If children whose hemispheric asymmetry has developed normally enter a many-sided developmental environment, this becomes a supportive factor for their cognitive and creative potential. If the activation of left-hemisphere thinking is balanced with the stimulation of imaginative and visual imagination, learners can develop their creative potential fully and effectively. The balance of logical and imaginative thinking is therefore the principal mechanism in enriching learners' cognitive models and in activating their creative imagination. This does not mean that the school should weaken the formation of logical thinking, which remains the condition of verifiable knowledge; it means that the school must stop treating imaginative work as a preliminary stage that can be shortened in favour of formal exercises.

Creative imagination also reveals the qualities of the personality, since in creative activity not only objects are created but also the distinctive qualities of the person are disclosed. Imagination has a tendency to be embodied in life: it strives to be effective, active and transformative with respect to what its activity is directed at. For this reason creative imagination emerges as the foundation for forming and developing the creative qualities of the personality. In those who merely dream, imagination remains poorly elaborated within the inner sphere and is not embodied in artistic or practical invention; the difference between the dreamer and the creator lies not in the intensity of imagination but in its materialisation. Instruction must therefore be aimed not only at enriching learners' memory with the most important scientific know-

ledge but also at the continuous development, on that basis, of creative and systematic thinking.

4.2 Conclusion

Creative imagination is a product of the intellect tested through the personal-motivational structure, and it can stimulate the desire to know, exploratory activity, the capacity to think in various directions and the performance of evaluative operations. Its core is the creation of new material and spiritual values, and the personal and motivational factor is the leading one in this process. Creativity is a type of activity, since the personality develops and manifests itself in activity; intellect and thinking are necessary because in the course of life every individual discovers individually new and previously unknown phenomena, processes and events. The neurophysiological analysis adds to this a pedagogical condition: the development of creative imagination depends on an environment that maintains the balance between logical and imaginative strategies of thinking, enriches experience, supports interest and requires the materialisation of imagined constructions in a product. Where this balance is destroyed in favour of routine formal operations, the creative potential of learners is not developed but gradually reduced.

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