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PSYCHOLOGICAL ISSUES OF TAKING INTO ACCOUNT THE DEVELOPMENT AND CHANGES IN THE BRAIN STRUCTURE OF ADOLESCENTS IN THEIR UPBRINGING

Abstract. The article discusses the mechanism of development of the human brain, the characteristics of this development during adolescence, which is an important part of human life. In the modern world, it is incomplete to talk about the features of this period, without taking into account the conclusions of neuroscience, the quality of physiological changes, without being aware of the parameters of the adolescent brain. When we are aware of the basic developmental structure of the adolescent brain, we will be able to more easily manage the process with them, and instead of spending this period as a "transition period", we will learn how to use it more effectively. It is no coincidence that the founder of the Children's Research Movement, Granville Stanley Hall, called this period "the birthday of the imagination". This article also explains the psychological aspects of physiological development, especially the changes in the brain and nerve cells that occur during adolescence. The influence of the cerebral cortex (cortex), especially the forebrain, on the thinking, behavior, reactions and activities of teenagers has been investigated, and why teenagers have difficulties or behave incoherently in issues such as decision-making, conclusion, analysis, self-control, self-control has been substantiated. It is known that adolescence is considered one of the main stages of human life. The orientation established or developed in the child during this period can last a lifetime. Thus, the period of adolescence is not only a period of hormonal changes, but also a period in which various conditions are manifested in the structure of the brain.

Keywords: adolescence; brain; transition period; neurons; nerve cells; synaptic pruning.

INTRODUCTION / ВСТУП

Formulation of the problem. Until recent times, it was believed that the development of the human brain is already completed at the age of 4–5 years. Therefore, changes, especially in adolescence, were interpreted mainly by hormonal imbalances and peculiar features of the transition period. In traditional approaches, such characteristics of adolescents as impulsive, rebellious, “unusual” behavior, indecision, laziness were completely explained by hormonal changes. Today, already scientific studies prove that the development of the human brain lasts until the age of 24–25 years. This means that it is very important to study new approaches to adolescents. Because it is already known that it is wrong to treat the adolescent brain as an adult human brain that has already completed its development.

Of course, the influence of hormones on human behavior and psyche cannot be denied. Adolescence is characterized by the rapid growth of height, the increase in metabolism in the body, the sharp increase in the activity of internal secretion glands, and the onset of sexual maturity [1, p. 305]. However, it should be known that all these processes do not occur independently of the brain. The changes in the adolescents' physiological parameters (characteristics such as chest area in girls, facial hair in boys, growth of height in both sexes, etc.) make them look like an adult, so adults' expectations of them suddenly increase. However, when we look at the structure of the adolescent's brain, the reason for the inadequacy of adolescent behavior is better understood.

The human brain is an indispensable structure due to the fact that it has the largest network of connections among human or natural systems on Earth and with trillions of synaptic connections [2, p. 10]. Awareness of the adolescent brain is very important due to its direct impact on cognition and behavior. If the changes in the structure of the adolescent's brain are thoroughly known and used correctly, important abilities are acquired not only in that period, but also in the rest of the stages of life. If it is known how the brain changes during adolescence, it is understood what form the decision-making process also takes.

It is already considered a primitive approach to associate adolescence only with the development of some hormones, to look at this period in its traditional form as a “transient”, “difficult”, “transitional” period. It is a fact that there are developments and changes in hormones during this period. However, to attribute all the characteristics of adolescence to hormones would cause us to overlook other aspects of the issue. As early as 1904, Granville Stanley Hall, the founder of the Child Research Movement, called adolescence the 10 best years of life, stating that In no other age is man so sensitive to the well-intentioned and

wise attempts of adults. And in no other spiritual soil do seeds, both good and bad, take root so deeply, or produce results so quickly and accurately [3].

It is known that nerve cells – neurons, which are the basis of the structure of the nervous system, are special cells that ensure the conduction of information within the nervous system. The human brain consists of a huge amount of neurons. Some scientists report that the number of neurons is more than 100 billion (approximately as many as the number of stars in the galaxy) [4, p. 45]. Physiologists, adherents of neuron theory, analyzed a number of physiological phenomena and came to the conclusion that neurons are separated from each other, and there is a connecting surface between two neighboring neurons. This connecting surface is a semiconductor dice that delivers nerve impulses from one neuron to another. This surface that connects two neurons to each other is called a synapse [5, p. 180].

The brain is considered the organ that least completed its development in the human body after birth. At this time, physiologically, the brain is only in 40 % of its own development. As it grows, along with the physiological structure of the brain, internal communications also change.

The main change in the brain of adolescents is synaptic pruning (decrease in gray matter) and myelination (increase in white matter), which is observed especially in the forebrain cortex. Gray matter is the nerve cells that form the basis of the brain, and white matter is the connections that ensure the passage of information from one part of the brain to another. This situation is often likened to a car with an engine running at a high speed, but not knowing where to go. Under the outer layer of the brain, in the cortex there is white matter. Most of the brain cells are located inside the gray matter. While neurons communicate directly with nearby nerve cells, the signals they send to neurons located in the spine are transmitted through white matter to activate muscles and nerves in other parts or hemispheres of the brain or in other parts of the body [6, p. 41]. According to studies, the amount of gray matter peaks at the age of 11 in girls and 14 in boys, and increases and decreases throughout adolescence. The amount of white matter or myelin in the brain, on the other hand, only moves on an increasing schedule during this period. This was revealed by J. Giedd and the staff of the US National Institute of Mental Health as a result of their research on the brains of 1000 children between the ages of 13 and 18 [7]. First of all, the brain loses some of the nerve cells (those that are not used) and their communications, which are growing until that period. This is called synaptic pruning. Experiments determine which nerve cells will be pruned. This also means that lesser-used abilities are also removed. For this reason, although the cerebral cortex thickens at the beginning of adolescence, this thickness gradually

decreases. Through synaptic pruning, in other words, neuroscientific cleaning, the cognitive activities of the adolescent are strengthened and the coefficient of usefulness of the brain increases.

The second major change that occurs in the brain of adolescents is myelination. Myelination means that the axons that provide communication between neurons are covered with a layer of myelin. Myelination is also characterized by the proliferation of white matter in the forebrain cortex (prefrontal cortex). Due to synaptic pruning and myelination towards the end of adolescence, adolescents are able to perform tasks that require more complex cognitive activities. Throughout adolescence, the cerebral cortex and intercortical connections continue to develop. In the corpus callosum, which connects the right and left hemispheres of the brain, axons thicken and become stronger. At the same time, the nerve tissue between the frontal and temporal cortices thickens and becomes myelinated, and these changes accelerate the exchange of information between neurons [8].

While the hippocampus, which performs learning and memory functions, is formed earlier in girls, the amygdala, which is the source of emotional reactions, develops earlier in boys. The amygdala is a complex almond-shaped structure located in the limbic system of the brain. Its main function is to associate emotions with appropriate response patterns, to respond at a physiological level, or to prepare a behavioral response. The amygdala also performs topical tasks such as coordinating the somatic expression of emotions, assessing the emotional meaning of experiences, managing feelings, satisfaction or fear responses in the brain. At the same time, we must state that during this period the forebrain develops later. The reason why adolescents react more emotionally than adults can be explained precisely by the fact that the forebrain does not complete its development against the background of the rapid development of the amygdala. The main functions of the forebrain are functions such as control, judgment and perception, decision making, conclusion, analysis, self-control. Since the brain is formed from the back to the front, this part of the brain during adolescence is the least developed and least connected compared to other parts. It is assumed that the forebrain was formed at about 20–22 years of age. It is at this age that young people begin to control their emotions, as well as acquire personal discipline, focus on more conscious activities, and effectively use the mechanisms of thinking, interpretation and decision-making [9].

The last part of the neural connections in the brain to be connected is the frontal part. An adolescent has completed only 80 % of brain development. The remaining 20 % is the part with the least communication, but has very important functions. This is important information in understanding why adolescents show

unusual behavior, often behave aggressively, have difficulty restraining emotions, communicating with adults, are easily distracted, are more prone to risky behavior, are focused on pleasure [6, p. 51]. In addition, when a person is under stress or feels fear, the thalamus sends information to more primitive parts of the brain, such as the oblong brain, instead of sending it to the area of the cortex where thinking and learning take place. As a result of this, instinctive behaviors are observed in that person, not rational thinking [10, p. 26].

Analysis of major research and publications. One of the main concepts of the research topic is upbringing. Until now, the concept of upbringing has been given different definitions. In the textbook “Pedagogical psychology”, B. Aliyev [1], A. Aliyeva [2], A. Gadirov [5], S. Hasanli [3], F. Ibrahimov [6] consider the educational process to be a goal-oriented, consistent and professional activity of a teacher or educator for the maximum development of a child's personality, to adapt it to the conditions of modern culture, to acquire the necessary qualities for a person to be the subject and strategist of his own life. In another literature, upbringing is presented as “purposeful, planned and organized formation of national and universal qualities in the young generation, which are related to behavior and are considered useful for the family and society”. One of the most common definitions of upbringing in pedagogical and psychological literature is as follows: “Upbringing is the purposeful, planned, organized transfer of knowledge, skills and experience acquired by the older generation to the younger generation.

AIM AND TASKS / МЕТА ТА ЗАВДАННЯ

Understanding of the relevance of this work allowed to formulate the **purpose** of this study: achieving positive qualitative changes in the educational process of teenagers with the application of NLP within the framework of modern conditions, offering new psychological-pedagogical methods that increase the efficiency of the educational process. As a result, this will contribute to the process of educating teenagers in accordance with the requirements of the time, adhering to the national and moral values, with the most modern methods of approach.

In order to achieve the goal set for the study, the following specific **tasks** are identified in the course of the work:

- 1) analysis of existing literature on the problem, development of scientific and theoretical foundations of the problem;
- 2) examination of the current situation on the organization of the upbringing process in adolescence, the level of efficiency and suitability of upbringing methods;

3) generalization of research results on the essence, content, patterns of the upbringing process, analysis of their connection with gender, age and individual characteristics;

4) investigation of the influence of the higher nervous activity of adolescents, including their mental development, on the educational process;

5) identification and systematization of the psychological aspects of the use of NLP in the process of educating adolescents;

6) compilation of a program containing NLP techniques, development of relevant proposals and recommendations that make a positive contribution to the organization of the process of educating adolescents.

In this study, we proceed from the position that there is no child who is problematic, hardly brought up, who does not understand and does not accept. Greater success in educational work can be achieved if the child is properly communicated with, treated with the appropriate method.

The effectiveness of the upbringing process will be even higher if the individual characteristics of those brought up are taken into account.

THE THEORETICAL BACKGROUNDS / ТЕОРЕТИЧНІ ОСНОВИ ДОСЛІДЖЕННЯ

The main provisions of the study and its results enrich pedagogical psychology with new theoretical knowledge. It forms a new approach in the upbringing of adolescents, their formation in the national-spiritual spirit, creates a fundamental basis for conducting new research in this area. Researchers conducting research in the field of training can refer to the provisions and results of the dissertation.

The results obtained from the study can be widely used by parent-teacher – school psychologists in their approach to adolescents, in raising their motives for training, in the implementation of work related to training, in the correct orientation of interaction in society, social environment, and family in educational institutions. The cerebral cortex, which is the largest fragment of the brain, accounting for 85% of its weight, and has the largest number of nerve cells, surrounds the rest of the brain like a half and a-shelled walnut. Due to the fact that the cerebral cortex is the last part of the brain that completes its development, it is vulnerable to environmental factors over a longer period of time compared to other parts of the brain [11, p. 167].

As we mentioned, the development of the brain works on the principle of back to front. Another change in the brain of adolescents occurs in the cerebellum (cerebellum), which is part of the posterior brain. It is known that the cerebellum regulates our movements by controlling our muscle activities.

This part of the posterior brain is used when passing the thread through the needle, when performing operations, playing the piano, cycling [12, p. 62]. The cerebellum continues its development during adolescence and ends its development towards the end of this period. It is for this reason that adolescents often find it difficult to maintain their balance, cannot properly regulate hand-arm movements, and commit minor accidents.

American professor Daniel Siegel stated that changes in the brain during adolescence form four main characteristics in the cognitive activities of adolescents. The scientist also indicated the pros and cons of these characteristics:

1. Novelty. This is born from the need for reward, which allows you to build more meaningful relationships in life. The positive aspects of this feature are partially abandoning traditional methods and finding new ways, identifying new ideas and approaches, and not leading a monotonous lifestyle. The downside is that not taking the risk factor into account in the excitement can result in dangerous behavior and even injury. Due to the search for originality, the instinct to act quickly leads to immediate action without thinking about the consequences.

2. Social engagement. Social relationships are aimed at strengthening the relationships of adolescents with peers and building new friendships. Research has shown that these relationships are the source of lifelong health and happiness. This can be noted as a positive aspect of social relations. On the negative side, a lifestyle that is almost completely isolated from adults, especially parents, and surrounded only by peers, leads to an increase in risky behavior in adolescents.

3. Emotional spark. Living with an emotional state means a more energetic, life-loving, exuberant, willing and enthusiastic way of life. The negative side of this situation is that extreme emotionality can cause a teenager to make sudden decisions, behave inappropriately, and show inappropriate reactions.

4. Creative explorations. It is known that J. Piaget (1896–1980), one of the main figures of cognitive psychology, included the period of adolescence in the period of abstract operations in his famous theory [4, p. 462]. This prompts teenagers to consider the current situation, think about problems and find solutions, new ideas and discoveries. Going beyond the boundaries of the monotonous lifestyle that adults often adopt, trying new and different experiences, experiencing a kind of life from a broader perspective, and so on can be counted among the positive aspects of creative exploration. When adults stop using their creative exploratory potential, they look at problems with a

repetition of habits. This also means not taking advantage of the capabilities of the imagination.

Professor Daniel Siegel likens the conflicts between adults and adolescents, or rather, the attitudes of adults towards the main characteristics of adolescence, to resisting the natural flow of a waterfall. He states that the strength of adolescence will find a way to manifest itself in the outward behavior and thinking system of the growing young man. You cannot stop the flow of the waterfall, but you can change its direction and use its power [13, p. 39].

Professor Sinan Canan, an expert on the brain, says that many of the issues people complain about with young people are actually related to behavioral patterns that depend on different stages of brain development. Disagreements with family members and other adults arise from the fact that young people have not fully mastered the ability to correctly read the intentions of other people's behavior. During this period, the young brain begins to better understand the boundaries, points of view, and how the world looks from the eyes of other people through the various conflicts and confrontations it experiences with the people around it, and to establish the connections in the brain on this level. Those seen from the outside are usually naughty, disaffected, and sometimes withdrawn, aggressive young people [15, p. 57].

RESEARCH METHODS / МЕТОДИ ДОСЛІДЖЕННЯ

Study methods: The following methods were used in the study process:

1. Theoretical analysis – scientific sources published especially in recent years have been investigated on the problem.
2. Observation and interview – the cognitive activity and behavior of adolescents in the learning process and in the extracurricular environment were observed, the initial situation with the problem was investigated through interviews, the results obtained in the research process were clarified.
3. Experiment – an experiment was conducted to measure and evaluate the initial state and the results obtained using NLP.
4. Quantitative and qualitative analysis of the results was carried out by statistical methods.

RESULTS OF THE RESEARCH / РЕЗУЛЬТАТИ ДОСЛІДЖЕННЯ

As a result, considering that the human brain is still being studied, we can note that research will expand further as new discoveries about the adolescent brain emerge. When approaching adolescents, we must not lose sight of the fact that they have not yet completed their own development, that their character is not fully formed. Adolescence is a learning period and should be used well. The

structure of the adolescent's brain is a topic that has not been seriously investigated until recent years. From this point of view, it is certain that new information will emerge in the background of ongoing research.

In conclusion, given that the human brain is still being studied, we can note that research will expand further as new discoveries about the adolescent brain emerge. When approaching adolescents, we must not lose sight of the fact that they have not yet completed their own development, that their character is not fully formed. Adolescence is a period of learning and this moment should be used well. The structure of the adolescent brain is a subject that has not been explored in the strict sense until recent years. From this point of view, new information will appear in the light of the ongoing research.

The formation and development of speech and thinking takes place on the basis of interaction and conditions each other.

The basis of a person's form of understanding objective reality is speech. The subjective approximation of objective reality is conditioned by the linguistic capabilities of the individual.

Thinking is accompanied by speech, expressed by language, but at the same time they also have a direct impact on thinking.

The perceived information is not as it is, but is reflected or transmitted to the recipient (the person receiving the information) by passing it through the "brain filters" of the individual, that is, "processed" in the brain and put into a certain form.

It is also possible to change the effect of that event by changing the expressions used when describing any event. Therefore, the style of expression should be chosen in accordance with the desired emotional state.

The emotional impact of events is in harmony with the means of expression. This also indicates the possibility of controlling emotions, which are one of the most important factors of self-government for a person.

CONCLUSIONS AND PROSPECTS FOR FURTHER RESEARCH / ВИСНОВКИ ТА ПЕРСПЕКТИВИ ПОДАЛЬШИХ ДОСЛІДЖЕНЬ

The fact that the educator is familiar with the individual "maps" of those being brought up, at least taking into account the variety of these maps, makes the upbringing process more efficient.

The deep structure of processes is formed and strengthened by experiences, which determines further human behavior and reactions. Realizing this structure, it is possible to carry out certain changes in it. This, in turn, allows you to change the meaning of thoughts, depending on this, emotions and, consequently, behavior as well. Freedom from the stereotype of thinking,

acceptance of innovations, an approach to an event from a different position creates the basis for changing the structure of thinking. To form these characteristics in those who are brought up, educators need to develop these qualities in themselves.

In the process of upbringing, with the exception of national and universal values, specific goals can be determined that correspond to the capabilities and resources of each individual. Educators must believe that those who are brought up have the potential opportunities necessary to form a successful personality, and they must also regularly instill this confidence in them.

In order for the value instilled in the communication process to be sustainable, the continuity of its indoctrination is one of the main conditions. It is natural to lose trust in the sincerity of a person who often changes views in relation to one and the same value and demonstrates inadequate behavior in this regard. How and by whom it is taught is as important as what value is taught in upbringing. If the attitude of the brought up to the educator is not positive, if in the mind of the brought up, the educator is programmed as a person without consensus, with a contradictory character, then the quality of the upbringing process will be low here. If the educators, first of all, have the values that they instill, this will have a fundamental effect on those who are brought up, and a demonstration of adequate behaviour will be observed in them.

The upbringing process is realized not only on verbal grounds. A person in the position of a tutor should pay attention to the expressions that he uses during communication with the child, as well as his body language. He must take into account the fact that he himself can be an example in relation to the values that he imposes. At the same time, even if the child does not clearly express any of his problems, the educator must have the sensitivity to be able to hear from his body language that he has any problems.

We also offer a programming approach to openness to innovation in NLP. In addition to choosing from existing models, we encourage attention to the possibility of new models. In this case, we consider it appropriate to give preference to cause-and-effect relationships and logical sequences, in other words, to operations with thoughts based on imagination, and not to processes based on purely thinking. The causal relationships and logical structures of the imaginative models can be justified and interpreted later. What matters is that the resulting new model can explain or justify what is happening or what is likely to happen in any common sense way.

Considering that children's subconscious brain maps are shaped by the environment, primarily by their parents, from infancy, it is easy to understand that the lack of options for behavior at the appropriate time, and at the same

time making that choice, is not only their fault. Therefore, one of the main responsibilities of the educator is to provide the educated with various maps that will increase their positive choices. If in the child's brain there is not a single, but several forms of “good” or “right”, he will choose one of the right ones. Thus, as the chances of the right choice multiply, the probability of the wrong decreases.

Prospects for further research in this direction. A non-dynamic situation arises when behavior is generalized as a personality quality. When a static, i.e. dull accusation is expressed during communication, not towards specific behavior, but towards personality, the other person, instead of explaining the reason for his behavior, rises to defend his personality and, in many cases, is provoked into a mutual accusation. Personality is not fully contained by separate ideas and behaviors. Changing identity is much more difficult than changing behavior.

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ПСИХОЛОГІЧНІ ПРОБЛЕМИ ОСОБЛИВОСТІ РОЗВИТКУ ТА ЗМІН СТРУКТУРИ МОЗКУ ПІДЛІТКІВ У ПРОЦЕСІ ЇХ ВИХОВАННЯ

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Анотація. У статті розглядається механізм розвитку головного мозку людини, особливості цього розвитку в підлітковому віці, який є важливою частиною життя людини. У сучасному світі говорити про особливості цього періоду, не враховуючи висновків нейронауки, якості фізіологічних змін, не знаючи параметрів мозку підлітка. Коли ми усвідомимо основну структуру розвитку підліткового мозку, ми зможемо легше керувати процесом з ними, і замість того, щоб проводити цей період як «перехідний період», ми навчимося використовувати його більш ефективно. Не випадково засновник руху дитячих досліджень Гранвіль Стенлі Холл назвав цей період «днем народження уяви». Ця стаття також пояснює психологічні аспекти фізіологічного розвитку, особливо зміни в мозку та нервових клітинах, які відбуваються в підлітковому віці. Було досліджено вплив кори головного мозку (кори), особливо переднього мозку, на мислення, поведінку, реакції та діяльність підлітків, а також чому підлітки мають труднощі або поводяться неузгоджено в таких питаннях, як прийняття рішень, висновки, аналіз, самооцінювання. Обґрунтовано контроль, самоконтроль. Відомо, що підлітковий вік вважається одним із головних етапів життя людини. Сформована або вироблена у дитини у цей період орієнтація може зберігатися на все життя. Таким чином, період підліткового віку – це не тільки період гормональних змін, а й період, коли в структурі головного мозку проявляються різні зміни.

Ключові слова: підлітковий вік; мозок; перехідний період; нейрони; нервові клітини; синаптична обрізка.

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