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PSYCHOLOGICAL AND PEDAGOGICAL BASES FOR THE CREATION OF AN AUTOMATED SYSTEM FOR THE DIAGNOSIS OF LEVELS OF PERCEPTION CHANNELS DEVELOPMENT (PERCEPTION.GUIDE)

Abstract. The article describes the results of research on the process of human perception of information, the definitions of the main channels of perception of the external world, and the diagnoses of the prevailing channel. The experience and practical achievements of scientists are analyzed in the context of psychology, pedagogy, sociotics, neurolinguistic programming. Certain methods for diagnosing the dominant channel of human perception of information using electronic resources and software complexes are considered. An extended model of the process of human information perception is presented based on the three-element classification of personality types: visual, audial, kinesthetic. The main stages of the creation of an automated "*perception.guide*" system for diagnosing the leading channel of information perception with the purpose of choosing the most effective teaching methods using information and communication technologies are revealed. The advantages of using the system for educational purposes are determined.

Keywords: perception, representative systems, modality, channels of information perception, the predominant perception channel, the perception model, information and communication technologies (ICT).

1. INTRODUCTION

The problem setting. The success of education reform in the information society inherently depends on the results of the study of the individual trajectory of personality development of both participants of the learning process: the trainee and the educator under the influence of the active use of information and communication technologies (ICT). For the active cognitive activity of a person using innovative technologies, it is important to clearly understand and represent individual psychological characteristics.

Each person is different, but at the same time, there are many commonalities. All people perceive, accept, and understand the surrounding world, but according to their own dominant manner of perception. Some draw pictures in the mind, some hear amazing sounds, some perceive objects through smell, taste, touch or constructing objects. A person perceives the world with the main sense organs: eyes, ears, skin, nose, or tongue using the appropriate channels: visual, aural, and kinesthetic. Reality is usually available to all the organs, but the uniqueness of each person is that they either perceive information with the help of one or more of these channels, or employ them in a certain sequence. The process of perception of

information occurs at the level of higher mental functions (L. Vygotsky). Its result depends on the development of human sensory systems (B. Ananiev, L. Vekker, S. Kravtsov) and on the motivational component of the process of cognition (D. Elkonin, V. Davidov). The study of the content of the processes of perception, processing, and presentation of information in a certain form is actively continued by representatives of different sciences.

The need to study the psychological features of personal characteristics and to apply the results in the pedagogical sphere by means of ICT remains relevant and in demand. The diagnostician should pay special attention to solving the problem of determining the predisposition to one or more channels of perception of information. Determining the leading channel of human perception can lead to a recommended technology for instruction, the use of which will be most effective for improving the quality of the learning process.

Analysis of recent research and publications. The modern research on the study of personal characteristics is found in the fundamental works of leading scholars in the field:

a) general psychology (S. Rubinshtein, L. Vygotsky, A. Leontiev, I. Yakimanskaya, A. Petrovsky, B. Ananiev, etc.);

b) psychodynamic, humanistic, cognitive psychology (Z. Freud, K. Jung, A. Adler, J. Bruner, L. Wenger, A. Maslow and others).

Some attention should be paid to the contributions of scientists who were engaged in research and development of methods for diagnosing personality characteristics and made special contribution to the development of current science (R. Cattell, H. Eysenck, C. Leonhard, J. Kelly, S. Hatway, L. Sobchik, M. Lusher, W. Marston, I. Myers-Briggs and K. Briggs, L. Sondi) [1], [2], [3], [4].

In modern psychology, there are methods for the comprehensive study of all possible personal qualities of a person which help create an objective and complete characterization of the personality [5]. In [2], [6], the description and analysis of the techniques and conclusions about their use in psychological scientific and diagnostic studies were made.

There are many programmatic psychodiagnostic complexes of personality research. For example, *www.sobchik.ru* contains both the original works by L. Sobchik (Individual-Typological Questionnaire (ITQ), the Standardized Method of Personality Research (SMPR) – the Minnesota Multiphasic Personality Inventory (MMPI) [4], and adapted methods of studying the personality by the foreign scientists: M. Lyusher's Method of Color Selections (MCS), Method of Portrait Selections (MPS) by L. Sondi, etc. The software complex <http://stimulus.com.ua/> uses several methods for personal characteristics, in particular, DISC (Dominance, Influence, Steadiness and Compliance) and the Myers-Briggs Type Indicator (MBTI).

In the modern studies of individual psychological qualities of a personality, a special place is occupied by studying the process of perception of information, its representation and coding by different sensory systems (I. Yakimanskaya, M. Kholodnaya, T. Bandurka, A. Dusavitsky, E. Zaika, I. Zuev, A. Kocharyan, E. Frolova) [7], [8]. Thus, in [9] the author conducts a theoretical analysis of works on the study of representative human systems. The analysis focuses on the research according to the conceptual apparatus of different psychological schools.

Among the new psychodiagnostic research into the perception process, it is necessary to distinguish the following: the method of diagnosing the representative systems by I. Zuev [10], the diagnosis of the polymodality of personality perception in the educational process by T. Bandurka [11], the method for diagnosing the information coding styles by E. Frolova [7, pp. 54-59]. To determine the leading modality of perception, there is the diagnostic apparatus that uses the traditional techniques of S. Efremtseva, N. Vasilieva, blitz test by L. Broadway and B. Hill, BIAS-test of B. Lewis and P. Pusek [12].

The researchers of the individual styles of teaching in Western schools are engaged in determining the prevailing learning modality and selecting specific recommendations for improving the quality of education in the modern information society (R. Felder [13], N. Fleming and K. Mills [14], A. Champer, D. Clark, M. Ihne). The diagnosis of determining the individual learning style based on the predisposition to modality is offered online at

- <http://vark-learn.com/>,
- <http://www.cogni.net/lerntypentest/>,
- <http://www.vaknlp.com/vak.htm>,
- <http://www.nwlink.com/~donclark/hrd/styles/vak.html>,
- <http://www.bb-medien.de/index-g-784.html>,
- <http://www.businessballs.com/vaklearningstylestest.htm>.

Unsolved aspects of the problem. In the scientific literature, a variety of technologies, methods, tools for diagnosing and assessing predisposition to a type, depending on the leading modality, is proposed. However, most of the materials are suggested for a certain age category. The diagnosis is carried out on the basis of classical textual questionnaires; authoring methods often require funding. For the objective evaluation of the stages of the study, the presence of a specialist is important. The results of the diagnosis suggest a description of the appropriate type without psychological and pedagogical recommendations to improve the quality of the learning process of its active participants. Not all the methods are adapted for implementation with the help of technical means. Since the use of the modern information technologies for diagnostic purposes makes it possible to set and solve the above listed research and practical problems, it is appropriate to create a generalized automatic system for diagnosing the predisposition to channels of information perception to select the most effective methods of teaching using ICT.

The purpose of this article is to provide a rational for using "*perception.guide*" automated system for the diagnosis of the dominant channel of information perception. It is based on the analysis of fundamental research by those who studied the human perception process in the context of psychological and pedagogical sciences.

2. METHODS OF RESEARCH

In the article, a set of research methods is used: Theoretical (analysis of research works and user resources, comparison, classification, systematization and generalization of research results); Empirical (observation, questionnaire); Statistical (data processing with their subsequent interpretation and generalization).

3. THEORETICAL FOUNDATIONS

Analyzing the literature and the experience of the research about the process of perception of information by a person, the basic sources are: 1) in cognitive and pedagogical psychology: B. Ananiev, A. Leontiev, V. Nice, J. Bruner, L. Vekker, V. Molyako, M. Kholodnaya, L. Wenger, T. Bandurka; 2) in pedagogy from the point of view of developmental learning and active cognitive activity, in the concept of individualizing learning: L. Vygotsky, A. Leontiev, P. Galperin, N. Chuprikova, V. Zinchenko, E. Kucher, I. Yakimanskaya, V. Bykov, I. Zuev, E. Zaika, A. Dusavitsky; 3) in neurolinguistics programming: R. Bendler, J. Grinder, Fr. Pucelik, J. O'Connor, D. Seymour, B. Bodenhammer, L. Hall, J. Delozier, R. Dilts, A. Pligin, S. Prisyazhnyj; 4) in sociotics: A. Augustinavichiute, K. Jung, A. Kempinski, G. Eysenck.

There follows a description of the conceptual apparatus of the research.

Perception is the process of forming a subjective image of an integral object that directly affects the perceptive (sensory) systems – analyzers (introduced by I.P. Pavlov) of a person with the help of active actions of the structures of all systems of their body. Depending on the biological significance in the perceived subject and which analysis is used, either one or the other quality may be leading and the information will be recognized as a priority [15].

The sensory system is a set of peripheral and central structures of the nervous system responsible for the perception of signals from various modalities from the surrounding or internal environment. The sensory system consists of receptors, neural pathways, and brain regions responsible for processing the signals received [16]. The most famous sensory systems are: sight, hearing, touch, taste, and smell.

Modality (in practical psychology) is a common name for the channels of primary perception and internal processing of information. The term modality is also used to denote a qualitative characteristic of the basic properties of sensations obtained as a result of the perception of signals from the external world and internal sensations. Modal characteristics reflect the properties of objective reality in a specific encoded form (the length of a light wave is reflected as a color by sight, the frequency of sound waves as tone and timbre by hearing, smell by smell, etc.).

As noted above, three main modalities or channels of perception are distinguished: visual (see), auditory (hear) and kinesthetic (feel), based on bodily and internal sensations, taking into consideration the taste and smell.

A person perceives information, processes, generalizes, stores and uses it in a form convenient for him/her: images, sounds, sensations. People use their senses in an external way to perceive the world, and in an internal way, to "represent" (re-imagine) experiences to themselves.

The representative system (RS) is the system of representing the consciousness of information about the surrounding world encoded by one or more sensory systems [17, p. 19]. Each of them functions in the formation of experience in three ways: as an "entrance" system (channels of perception), as an internal system of "representation", as an "exit" system. The concept of the RS includes the characteristics of both modalities: "entry" and "exit". These modalities may not coincide; but their connection forms a cognitive personality style [9, p. 46].

The following classification of human RS is commonly accepted:

- 1) visual (visual images);
- 2) audial (audio information):
 - auditory-tonal (sounds and tonal sequences);
 - audial-digital (symbols, words);
- 3) kinesthetic (information obtained through the olfactory-tactile channels);
- 4) digital (information acquired by subjective-logical comprehension of signals received by the above three channels by a person).

The whole information is filtered by sensory representative systems. Physiologically, a person can perceive only a certain part of the real world. For example, light is perceived by the eye in the wavelength range of 380-680 nm; sound is perceived in the range of 20-20000 Hz [18, pp. 9-10]. The odor of many harmful substances is felt by a person only when their maximum permissible concentration (MPC) is exceeded by several times. Everyone, by default, uses all representative systems to a certain extent, but gives preference to one RS in comparison with others. The system through which more bits of information pass per unit of time and which will ensure the completeness and character of the perceived object is considered predominant. It is also called dominant, primary, or leading.

In addition, the following concepts are used: leading modality, dominant perceptual modality, the leading channel of perception, the predominant perception system. The conceptual apparatus depends on the science in the sphere of which the concept is considered.

4. RESULTS OF THE RESEARCH

The presentation of the main material has two sections:

- 4.1. Analysis of the process of perception of the external world in the context of different sciences.
- 4.2. Description of the main stages of creating an automated system the "*perception.guide*".

4.1. The general purpose of determining the dominant channel for the perception of information is to experience, develop, improve the personality and his/her individual characteristics by activation of cognitive and intellectual activity; by improvement of communication skills; and by creation of a comfortable life in the modern information society. This goal reflects the influence of the dominant modality on the individual, whose place and role in society are considered by different sciences.

Different approaches to this problem:

4.1.1) psychology reveals the mechanism of obtaining, processing, generalization, preservation and transmission of information by a person for his/her successful development and self-improvement;

4.1.2) pedagogy allows the activation, development, and improvement of an individual's characteristics in the process of learning and cognizing the external world;

4.1.3) neurolinguistic programming allows the improvement of communication and the achievement of success in interpersonal relationships;

4.1.4) socionics promotes the comfortable adaptation of a person in the information society by strengthening interdisciplinary connections between informatics, psychology and sociology, the main cell of which is a person.

Let us examine the process of perception in the context of different sciences.

4.1.1. The study of human perception systems and the study of the predominant role among them are in the focus of cognitive and pedagogical psychology. The studies in cognitive psychology originate in the 1950s and 60s during the period of active study of individual differences in perception, analysis, preservation, and reproduction of information [9, p.11]. The human psyche is an integral, sensory system that functions in a coordinated manner. RS can be viewed as general cognitive modes of interaction of the individual with information, the representation of which occurs through coding.

Representative systems through the notion of the perception modality as a psychological category are investigated and discussed in the works of B. Ananiev (1960), A. Leontiev (1965, 1982), N. Chuprikova (1997), A. Vezhibitskaya (1996) etc.

M. A. Kholodnaya defines representative systems as cognitive styles of representation and transformation (coding) of information within the limits of cognitive modalities: visual, auditory, etc. Styles of information coding are subjective means by which the surrounding world reproduces in the mental experience of a person depending on the dominance of a certain modality [19].

Psychological analysis of the basic methods of encoding and filtering information was first presented in the works of J. Bruner, who pointed to the existence of three ways of subjective presentation of information: in the form of objective actions, visual images and linguistic signs (action, image, word) [20]. Information on this chain can go from one

cognitive modality to another or remain in the same modality. The most capacious and effective is the process of converting perceived information into a language form.

Representatives of the field of cognitive psychology are convinced that internal cognitive structures prepare the individual for accepting information in a certain rather than arbitrary manner, thus overseeing people's cognitive activity [8, 21, 22].

V. Ananiev made an important contribution to the solution of the question of the prevailing RS. He noted that the dominance of any representative system means not only active exploitation of it in terms of perception and description of the world, but is a complex of features of behavior, emotional response. Based on the prevailing representative system, a special organization of the individual's properties is built, and a certain type of personality is formed: visual, audial, kinesthetic, digital [23, pp. 45-46]. V. Ananiev considers the representative system as one of the common personal characteristics. He believes that digitalism is inherent in all representative systems, since the external world for a person seems to be sensory experience, and experience is described indirectly in language, in words.

The role of the dominant perception system is very important when filtering information by an individual. The central nervous system has the ability to evaluate information on two main features: the physical properties of signals and the subjective significance of information that are associated with the activity of different brain structures [19].

In the process of perception of the surrounding world, some information is blocked, discarded, and does not enter memory cells. These are the features of the mental processes of a person. The external world is imagined by an individual in the most accessible categories. This blocks our ability to perceive other, less accessible categories [20, p. 52].

Many studies on the problem of determining the dominant system of human perception of information have been conducted and their results analyzed. Psychology, by definition, employs:

1) empirical methods: a) observation; b) experimental: laboratory, natural, formative methods; c) psychodiagnostic methods: tests, questionnaires, interviews, conversations.

2) methods of data processing: a) quantitative (statistical); b) qualitative (differentiation of the material into groups, analysis).

Most often, in determining the leading system of perception, the study of individual characteristics of a person is just beginning. Thus, most psychologists tend to assume that in the cognitive activity of an individual, it is necessary to train, activate and develop all human systems.

The approach to carrying out the research method by each psychological school is developed and supplemented constantly. The international experience of solving the described problem is rich and diverse, but the achievements of domestic scientists deserve special attention, as the results of their studies take into account the lifestyle, mentality, and approach to the learning process in Ukraine.

4.1.2. In pedagogy, the study of representative systems also has developed in several directions – the influence of the dominant RS on the effectiveness of the learning process, the impact of the learning process on RS; recognition, activation and development of all RS of the trainee; influence of the leading RS on students' memory, attention, thinking, etc. The definitions of individual characteristics of pupils correspond to the basic principles of modern education: scientific, accessible, clear, conscious and active students, individualization, etc.

P. Y. Galperin assigns a special role to human learning, in the course of which various types of mental actions activate the main types of students' RS: first kinesthetic and visual – when working with real objects and models; then audible – when pronouncing out loud and to themselves; visual and at the same time kinesthetic – when writing; digital – with the assimilation of theoretical concepts [24].

Modern researchers, such as V. Bykov, V. Molyako, E. Zaika, I. Zuev, M. Boychuk, E. Frolova are actively engaged in the study of human RS and the choice of means for optimizing the educational process [7], [9], [10], [22], [25]. Many researchers, taking into account the results of studies of dominant RS, offer methods and approaches for the development of all human RS, and develop new techniques and technologies to improve the effectiveness of the cognitive process. All the previous research of the psychological sciences in this direction is transferred to the pedagogical branch.

Analyzing the concept of developmental learning of D. B. El'konin-V. V. Davydov, it should be noted that it is based on the development of the ways of representation of knowledge through the activation of all cognitive modalities of schoolchildren of younger age. Development of complex cognitive abilities of pupils of lower grades in developmental learning occurs along the line: subject-action-image-language-concepts (P. Y. Galperin, A. V. Zaporozhets, S. N. Karpova).

The formation of the child's abilities occurs with the development and complication of their cognitive actions in the course of learning activity. In this way, the means for the image of knowledge are successively mastered: from objective actions through images to scientific concepts. External cognitive actions are gradually internalized [22]. Means of representation of information in cognitive activity find a correspondence in the main types of thinking. Subject and mental actions – in visual-efficient thinking; Images – in a visual-figurative; signs (texts, concept) – in verbal-logical (abstract).

V. Bart and colleagues in 1979 in their work "Learning through the leading modality: theory and practice" offered three styles of learning: visual, audial and kinesthetic (VAK). Many researchers hold the opinion that human modalities exist independently or in combination (most often in humans, visual or mixed modality prevails), the change in the prevailing modality depends on the age and the level of development of other modalities.

N. Fleming expanded the use of sensory modalities in accelerated learning technology by creating the VARK system: visual learning, audial learning, reading/writing, kinesthetic learning. The visual pupils prefer visual material (visual aids, saturated with graphs, diagrams, diagrams, symbols, etc.), audials – lectures, discussions, conversations, etc. The kinesthetic prefer to learn with their own experience of movements, touches and actions (active development of the world, scientific projects, experiments, etc.). Fleming's model also postulates several types of multimodality (<http://vark-learn.com/>) [14].

The pedagogical process presupposes a unity in the development of all human RS. The study of the students' leading RS is the task of every educator. After all, the subsequent results of his/her cognitive process depend on the correct and timely determination of the dominant RS of the student. Psychological and pedagogical approach to the definition of leading modality involves the use of the same research methods: observation, testing, and experiment.

Today, there are many online materials to help the educator with determining the leading RS and detailed advice for creating a successful system for the learning process, taking into account the individual characteristics of each student.

4.1.3. The notion of a representative system is associated with neurolinguistic programming, which is the direction in psychotherapy and practical psychology based on the technique of modeling verbal and nonverbal behavior of people, and on the evaluation of the set of connections between the forms of speech, the movement of the eyes, the body, and memory.

Neuro-linguistic programming (NLP) was developed jointly by R. Bendler, J. Grinder, Fr. Puseelik, Gr. Bateson at the University of California Santa Cruz in the 1960s and 1970s.

Representative systems in NLP are identified with modalities, which, based on information from the senses, are the only way to obtain information about the surrounding

world [17, p. 15]. The theory of RS was described in the book "The Structure of Magic, Volumes I and II" of 1975-1976. The progenitors of NLP are R. Bandler and J. Grinder.

In NLP, they adhere to the following classification of human RS: visual, audial, kinesthetic, and the sphere not related to feelings – digital. J. O'Connor and D. Seymour use RS to understand the ways in which we receive, store and encode information in our brain: pictures, sounds, sensations, smells and tastes [26, p. 50], [27]. According to NLP, the representation of information is one of the key concepts. At the same time, representation is understood as the transmission of information to consciousness (coding its cognitive modalities), and its re-introduction (re-encoding) for further use in cognitive activity.

According to the way information is processed, RS are very different. Visual RS – equidirectional and simultaneous, audible RS – step by step and sequential, kinesthetic RS – analogous and selective [26, p. 70]. In the visual and auditory systems, there is the past (images), the present and the future (construction), the kinesthetic system has only the present (*gestalt* – "here and now") [28, p.13].

The acquisition, processing, preservation and transmission of information by a person is a complex process in which a variety of physiological, neuropsychological mechanisms are involved, influenced by many external factors. The results of these are displayed in the actions, movements, gait, gestures, and speech of each individual. The information is received in a particular manner, passes selection, is processed by means of internal filters, and is finally transformed by means of internal representations (IR) in images intelligible to the person.

The dominant RS for humans is most effective and convenient. It is sometimes called an input system, because it supplies materials for conscious consideration. Most people have a preferred input system, but it does not have to match their primary system. A person can have different leading systems for different types of experiences. For example, one can use pictures in order to recall some painful experience, and sounds to restore some pleasant experience [27, p. 20]. Such an RS in the process of communication is a means of direct and rapid access to the consciousness of the co-speaker (interlocutor).

The easiest way to determine the prevailing RS is by access keys, in particular, by eye movements during answering certain questions. This discovery was made by R. Bandler and J. Grinder at the beginning of the development of NLP. Later it was described in the book "From Frogs to Princes" in 1979 [29]. A certain movement of eyes indicates specific processes in the nervous system. 95% of right-handers look up and to the left when they recall what they saw before (visual processing of data from memory); up and right when creating an image, collecting together its parts which they could never see before. The movement of the eyes to the left indicates the reproduction of words from memory, to the right – to the construction of sentences (the operation of the auditory system). If a person looks down and to the left, they conduct an internal dialogue – usually about important values and principles. In this case, there is a combination of two human senses. The person speaks to himself or herself the words that denote his/her feelings in relation to some important subject or an event. When a person looks down and to the right, they get access to kinesthetic data (sensations) and emotions. A look in front often indicates that a person creates pictures. However, many people at the same time are engaged in an internal dialogue. Left-handers and people with mirror localization of functions during reproduction and construction demonstrate reverse eye movements [17].

Types of people with one predominant RS are rare. In addition, eye movements often indicate a perceived image of a person, rather than their belonging to a particular type. One should also remember about synaesthesia – this is a "simultaneous experience" of sensory experience in two or more modalities, automatic communication of one RS with another. For example, the synesthesia of the visual and kinesthetic systems may imply the perception of words in certain colors.

Currently in the field of NLP, a huge world experience has been gained in the study of human RS. Upon analyzing the research on NLP, it should be noted that specialists in this field consider visual contact with a person. Therefore, the main methods for determining the dominant human RS are to study:

1) certain access keys [26, p. 118]:

a) speech predicates;

b) physiological markers:

- Patterns of eye movements;

- Minimal keys (appearance, body position and gestures, tonality of voice and speech rate, muscle tone, skin color).

2) test results (for example, the BIAS test, described in 1982 by V. Lewis and F. Pucelik (Lewis V., Pucelik F.)) [12].

In the modern information space, in particular the Internet, many online tests are available which give basic information about a possible RS. Many books have been published that describe different types of people with the corresponding RS. As a rule, they give trivial tests, which with some degree of probability can determine the type of person one belongs to, that is, which RS dominates. It is for people who set a goal to understand their abilities and perceptions. For this people, there are experts who will help them. After all, for use in research, for example, one needs access keys and some experience. Testing for the prevailing perception system is conducted. This will then show the most reliable and comprehensive results.

4.1.4. Socionics is the science at the intersection of psychology, informatics, and sociology which studies the processes of information exchange of a person with the real world and their influence on the psyche. The science was founded in the 1970s by the Lithuanian sociologist A. Augustinavichute based upon Jung's typology and A. Kempinsky's theory of information metabolism. Information metabolism is the process of processing, assimilation, and transmission of information by the human psyche.

By modifying the Jungian typology, socionics reveals the existence of certain variants of information exchange between subjects, depending on the sociotype inherent in them, also called TIM (type of information metabolism). From the "8-type typology" of Jung, socionics deduces the existence of sixteen socionic types.

The creation of types is based on the relation of the individual to the external world and their own sensations following the principle of a socionic dichotomy:

1) extraversion – introversion (external world – inner world),

2) logic – ethics (objective laws – human relationships),

3) intuition – sensorics (abstract information – specific information),

4) rationality – irrationality (smooth movement towards the goal – sensitive response to change).

According to socionics, its applied value is the correct estimation of a person's own potential and finding adequate ways of self-realization, professional choice, and an objective perception of the abilities and possibilities of others to build a more harmonious relationship with them [30].

In the 2000s, socionics was actively involved in the recruitment of personnel for companies. Methods of socionics are proposed to be used in pedagogy, in areas where collective professionalism is important, for completing surgical ambulance teams, etc.

The specialists on socionics are convinced that a person's understanding of their own mechanism of perception of information allows them to identify their strengths and weaknesses, find others who understand and accept it. Applied orientation of pedagogical socionics will allow the selection of types, methods, and forms of instruction, taking into consideration the typological properties of students [31].

In sociotics sixteen types of people are singled out and divided into groups of the same type. Thus, ideal partners, groups, collectives are formed. In the educational process, it is recommended that such an approach be actively used to obtain good results.

4.2. Analyzing the experience and practical achievements of scientists in the context of several sciences, the stages of the subsequent research were determined: the creation of the extended model of human perception of information with the description of characteristics for each of the twenty-seven types, the analysis and selection of test tasks for determining the predisposition to a particular training using ICT for each type of a person.

When creating a model of the process of human perception of information, the main three-element classification of personality types is chosen: visual, audial, and kinesthetic and it is extended to twenty-seven types. The main channels of perception are indicated: V – visual, A – auditory, and K – kinesthetic. Since most people use several channels at the same time, their combination and level of development was taken into account. A high level of development of the perception channel is indicated with "2", medium with "1", low with "0". The basic combination is VAK, and twenty-seven of its variants (ternary codes) are respectively: 000, 001, 010, 011, 100, 101, 110, 111, 002, 020, 022, 200, 202, 220, 222, 012, 021, 102, 201, 120, 210, 112, 121, 211, 221, 212, 122. Each variant of the described combination is associated with a type of person, depending on the level of channel development of perception.

Such distribution into types can be used by a specialist when processing the results of several research methods: observation, conversation, questioning, testing, experiment, etc.

To process the test results, the following notation is introduced:

$N(*)$ – the number of variants (statements) proposed in the test that give a characteristic to a certain perception channel (one of V, A, K);

$n(*)$ is the number of variants (statements) chosen by the subject (a testing learner) from the perceptual channel suggested by the characteristic.

The quantitative analysis of the test results consists in determining the ternary code and the corresponding type of the person according to the results of the study.

If, $n(*) > \frac{3}{4}N(*)$, then the level of perception * is assigned the value 2 (the test indicator is high).

If, , then the level of perception * – value 1 (test indicator – average).

If, $n(*) < \frac{1}{2}N(*)$, then * is a value of 0 (test indicator is low).

Qualitative analysis of test results offers the description of each of the twenty-seven types with recommendations and suggestions according to the purpose of the study. It is based on the description of the perception model with the corresponding characteristics of the test indicator (level of development and use) for each channel of perception. With subjective reflection of reality, the perception, processing of information and the design of the surrounding world takes the form of:

- ✓ Visual images and representations by the visual channel either always, or partially, or rarely, depending on the test indicator (high, medium, low);
- ✓ Sound images and presentations by the auditory channel either always, or partially, or rarely, depending on the test indicator (high, medium, low);
- ✓ Tactile sensations and internal experiences by the kinesthetic channel either always, or in part, or rarely depending on the test score (high, medium, low).

To create a universal automated system, approbated tests are selected that meet requirements of: validity, reliability, accuracy, uniqueness, and forecastability. The researchers also considered the following:

- 1) the age and physiological characteristics of the subject (a testing learner);
- 2) the simplicity and uniqueness of the formulation of test tasks;
- 3) simplicity and openness in the choice of response options (demonstration of all possible options at the same time);
- 4) limited time for completing tasks;
- 5) the independence of the results from the influence of the experimental situation;
- 6) standardized processing of results and the possibility of their comparison;
- 7) adaptation to the mentality of the subject and their current mental condition;
- 8) adaptability for use by technical means [26].

The work of the system is aimed at the target audience depending on the age. According to the age-specific features of personality development, three age groups are defined: four to nine years old, ten to seventeen years old and over seventeen years old. The junior level was created for preschool children and four-to-nine-year-old schoolchildren. The average level is intended for middle and senior school age. The senior level is created for students, parents, educators and other adults over seventeen years of age. Structurally, each part is divided into modules, the main of which are modules with testing. The method of testing depends on the age category of the subject (a testing learner). For each category, there is a choice of testing options: classical tests in the form of "question-answer" or colorful tests with a different form of information.

The thinking of four-to-nine-year-old children is predominantly visual-figurative, which means that children need to rely on visual material to perform mental operations. The child can effectively work at visual, tactile levels of perception. Therefore, it is more difficult for a child to remain attentive when using question-and-answer tests. Diagnosis of individual characteristics in a game form or using bright, visual elements that are of interest is more reliable, given the limitations of research methods and the absence of a specialist.

So, for these children, a test game consisting of three stages is proposed, the results of which will approximate the definition of the type of child relative to its leading perception channel.

At the first stage, the level of development of visual perception is checked. The child is shown pictures on a white background one after another. After this, the child is distracted by the movie, and she/he is asked to recall the images.

At the second stage, the level of development is auditory perception. The subject listens to a few words, one after another, and is then distracted by a video.

At the third stage, the level of development is kinesthetic perception. At this stage, the child sees the symbols on the empty screen in turn and prints each of them next to the image in an empty line. After that, the child watches an entertaining video and is asked to recall the symbols.

After passing through the stages, the results of determining the leading channel of perception and the type of the subject are summed up, recommendations are given on the effectiveness of using any ICT in training.

It is proposed that adults diagnose the predominant channel of their child's perception by testing in classical text form. Among the endings of the proposed statements, adults need to choose those that are closest to the characteristics of their child, depending on the type of person. In each sentence, you can choose one option for continuation, two or all. Each variant of the answer of one utterance refers to the characteristic of the corresponding channel of perception. The test results determine one of twenty-seven types to which the subject belongs and offer a type description with recommendations on the use of ICT in the learning process.

Children, in comparison with adults, use all channels of information perception evenly. With age, there is a dynamic of sensory preferences and the thinking of middle- and senior-school students becomes abstract. There is a development of concrete-figurative thinking;

therefore it is rational for them to use words when testing words, which they can mentally easily transform into images.

For secondary- and senior-school age (ten to seventeen years), it is recommended to choose the method of testing and obtain results with recommendations for improving the efficiency of the educational process using ICT.

The first version of the test contains colorful tests with different forms of information delivery, which are proposed to pass in two stages. Between the stages, the user is distracted by the solution of an entertaining task and then testing continues.

The second version of testing is proposed in classical text form. At the end of the test, the screen displays the results for determining the type of subject and recommendations for using the optimal forms, methods of submitting materials for achieving high results in the learning process using ICT.

The subjects of the third group (older than seventeen years) take the test in two ways: either in the form of a game or in the form of a text questionnaire. They must try to answer sincerely. They should not think long over the questions, since usually the first answer that comes to mind is the most faithful. At the end of the test, the results appear on the screen. On their basis a type is formed, to which the person is predisposed.

For each type of personality, it is recommended to use a certain teaching methodology with the use of specific methods, techniques and forms of organization of the learning process. A number of ICTs are listed, the use of which contributes to the effectiveness of the cognitive process.

In addition, it should be noted that the system was created to develop recommendations for the use of accessible ICTs [32], taking into account the individual trajectory of learning for each type of subjects (learners tested).

5. CONCLUSIONS AND PROSPECTS OF FOLLOW-UP RESEARCH

The complex analysis of works on studying the process of human perception of information in the context of different sciences allowed forming the theoretical basis for creating an automated system, "*perception.guide*", with the aim of revealing the personal qualities of users influencing the achievement of high results in the process of training and activities using ICT. As a result, the development of the system model of perception of information, analysis of IC technologies and developments of modern scientists and practitioners, valuable recommendations for each type of personality were highlighted. The age and characteristics of participants were also taken into consideration.

The system has several advantages:

- Taking/Passing the diagnosis and presenting the results without the presence of the specialist;
- Free access via the Internet;
- Minimal technical support necessary;
- Availability of the system materials for users from 4 years of age;
- Filling the content of the system with game, animation and graphic elements;
- Providing a choice of the form of testing: from classical text questionnaires to original tests with various types of information;
- Simultaneous diagnosis and advice on the use of ICT in the learning process;
- Selection of optimal IC technologies to increase cognitive needs of a person according to his/her type;
- The use of the system will allow the user to be properly organized into the process of cognition and activity, accounting for his/her individual characteristics.

The following directions remain promising:

- improvement of the work of the automated system in the psychological, pedagogical and economic aspects;
- introduction of the "perception.guide" system in pedagogical activity;
- the use of this project in the process of linguistic training and the study of sciences.

REFERENCES (TRANSLATED AND TRANSLITERATED)

- [1] L. N. Sobchik, *Psychology of Individuality. Theory and practice of psychodiagnostics. The detailed description of psychodiagnostics. techniques in different spheres of psychological activity*. SPb.: issued by "Rech", 2008. (in Russian)
- [2] M. D. Morov, "Diagnostics of personal qualities in the system of measuring procedures", Abstract of the Dis. PhD in Psychological Sciences, NIU Higher School of Economics, M., 2011. (in Russian)
- [3] Is. Br. Myers, *Gifts Differing: Understanding Personality Type*. Mountain View, CA: Davies-Black Publishing, 1995. (in English)
- [4] L. N. Sobchik, *Standardized Multifactor Method for Studying the Personality (SMIL). Practical guidance*. M.: OOO "Company BORGES", 2009. (in Russian)
- [5] M. K. Akimova, *Psychological Diagnosis: Training Manual*. Spb.: Peter, 2005. (in Russian)
- [6] N. P. Fetiskin, V. V. Kozlov, and G. M. Manuilov, *Socio-psychological diagnosis of personality development and small groups*. M.: Publishing house of the Institute of Psychotherapy, 2002. (in Russian)
- [7] O. S. Kocharyan, E. V. Frolova, V. M. Pavlenko, *Cognitive resources to ensure the success of students' learning activities*. Kh: Nat. Aerocosm. Un-ty n. a. M. E. Zhukovsky "Khark. Avia. In-n, 2011. (in Ukrainian)
- [8] M. A. Kholodnaya, *Cognitive Styles. About the nature of the individual mind*. SPb.: Peter, 2004. (in Russian)
- [9] M. P. Boychuk, "Theoretical Analysis of the approaches to learning of Representative Systems in Psychology," *The Bulletin of Kharkiv National University n. a. V. N. Karazin*, issue 50, No. 1032, p. 45-49, 2012. [Online]. Available: http://nbuv.gov.ua/UJRN/VKhIPC_2012_1032_50_13. Accessed: July, 26, 2017. (in Ukrainian)
- [10] I. O. Zuev, "Methodology of the Diagnostics of Representative Systems in Education," *The Bulletin of Kharkiv National Pedagogical University n. a. G. S. Skovoroda. Psychology*, iss. 22, p. 84-91, 2007. (in Ukrainian)
- [11] T. N. Bandurka, and T. V. Bomshtein, "Computer program for studying the polymodality of perception by the subjects of the educational process," *Experimental Psychology in Russia: Traditions and Perspectives*, p. 89-89, 2010. [Online]. Available: http://psyjournals.ru/files/32984/exp_collection_Bandurka.pdf. (in Russian)
- [12] Byron A. Lewis, and R. Frank Pucelik, *NLP The Magic of Neuro-Linguistic Programming without Secrets*. SPb.: Iss. H. "Rech", 2013. (in Russian)
- [13] R. M. Felder, and J. Spurlin, "Application, reliability and validity of the index of learning styles," *International Journal on Engineering Education*, vol. 21, no. 1, pp. 103-112, 2005. [Online]. Available: [http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ILS_Validation\(IJEE\).pdf](http://www4.ncsu.edu/unity/lockers/users/f/felder/public/ILSdir/ILS_Validation(IJEE).pdf). (in English)
- [14] N. Fleming, and D. Baume, "Learning styles again: VARKing up the right tree!," *Educational Developments*, SEDA Ltd., Issue 7.4, pp. 4-7, 2006. [Online]. Available: <http://vark-learn.com/wp-content/uploads/2014/08/Educational-Developments.pdf>. (in English)
- [15] V. K. Muldarov, and I. M. Kondakov, "Perception", in the *Psychological Dictionary*, O. Konorkin, 2000. [Online]. Available: <http://psi.webzone.ru/st/017900.htm>. (in Russian)
- [16] M. A. Ostrovsky, and I. A. Shevelev, "Sensory Systems", in *Human Physiology*. V. II, V. M. Pokrovsky, G. F. Korotko, Edm. M: Medicina, 1997, Chapter 14, pp. 201-259. (in Russian)
- [17] B. Bodhammer, and M. Hall, *The textbook of magic of NLP*. SPb.: Prime-Euroznak, 2003. (in Russian)
- [18] J. Grinder, and R. Bandler, *The Structure of Magic (in 2 volumes)*, 1975-1976. [Online]. Available: <https://www.e-reading.club/book.php?book=5401>. (in Russian)
- [19] M. A. Kholodnaya, *Psychology of Intelligence: paradoxes of the research*. SPb., M., 2002. [Online]. Available: http://intellect-invest.org.ua/content/userfiles/files/library/Holodnaya_Psihologiya_intellekta.pdf
- [20] J. Bruner, *Psychology of Cognition*. Moscow: Progress, 1977. (in Russian)
- [21] E. V. Frolova, "Analysis of stylistic features of perception: psychological and pedagogical aspects," *Bulletin of Kharkiv National University n. a. V. N. Karazin. Psychology*, № 913, p. 166-170, 2010. (in Russian)

- [22] E. V. Zaika, and I. O. Zuev, *The Ways of optimization of cognitive activity of students and schoolchildren: a manual for students, educators, practical psychologists*. Kh.: KhNU n. a. V. N. Karazin, 2011. (in Ukrainian)
- [23] V. A. Ananyev, "Features of the Discrete Personality Type in the Etiopathogenesis of Psychosomatic Disorders," *Bulletin of psychotherapy*, SPb, No. 10, p. 45-54, 2003. (in Russian)
- [24] P. Ya. Galperin, *Teaching methods and the mental development of a child*. Moscow: MSU Publishing House, 1985. (in Russian)
- [25] V. Yu. Bykov, *Models of organizational systems of open education: Monograph*. K.: Atika, 2008. (in Ukrainian)
- [26] A. Pligin, and A. Gerasimov, *Guide to the course of NLP-Practitioner*. Part 1. M.: Center for NLP in Education, 2000. (in Russian)
- [27] J. O'Connor, and J. Seymour, *Introduction to NLP*. Chelyabinsk: Peleng, 1997. (in Russian)
- [28] V. I. Elmanovich, *Neuro-linguistic programming (methodical manual for beginners)*. Part 1. Therapy. SPb.: Psychotherapeutic center "Lad", 1994. (in Russian)
- [29] R. Bendler, and J. Grinder. *From frogs to princes. Neuro-linguistic programming*. SPb.: Korvet, 2013. (in Russian)
- [30] M. A. Nikonova, and E. N. Rodina, "Prospects of Socionics in the Modern Society," *Man - Society - Culture: Set of Scient*. Saransk, Mordov. State Ped. In-n, Iss. 4, p. 82-82, 2012. (in Russian)
- [31] V. N. Antoshkin, *Pedagogical Socionics: Textbook*. Novosibirsk: Sib. Univ. Publishing House, 2008. (in Russian)
- [32] R. Yu. Tsarev, O. A. Vasylenko, "Classification model of information and communication technologies in the educational process," *Scientific works of ONAT n. a. O. S. Popov*. Odesa: ONAT, No. 1, p. 146-151, 2016. (in Russian)

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ПСИХОЛОГО-ПЕДАГОГІЧНЕ ОБҐРУНТУВАННЯ СТВОРЕННЯ АВТОМАТИЗОВАНОЇ СИСТЕМИ ДІАГНОСТИКИ РІВНІВ РОЗВИТКУ КАНАЛІВ СПРИЙНЯТТЯ (PERCEPTION.GUIDE)

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Анотація. У статті описані результати дослідження робіт щодо вивчення процесу сприйняття інформації людиною, визначено основні канали сприйняття зовнішнього світу і діагностики переважаючого серед них. Проаналізовано досвід і практичні напрацювання вчених у розрізі психології, педагогіки, соціоніки, нейролінгвістичного програмування. Розглянуто деякі методики діагностики домінуючого каналу сприйняття інформації людиною за допомогою електронних ресурсів і програмних комплексів. Представлена розширена модель процесу сприйняття інформації людиною, на підставі трьохелементної класифікації типів особистості: візуал, аудіал, кінстетик. Розкрито основні етапи створення автоматизованої системи *perception.guide* для діагностики провідного каналу сприйняття інформації з метою вибору найбільш ефективних методів навчання із застосуванням інформаційно-комунікаційних технологій. Визначено переваги використання системи в освітніх цілях.

Ключові слова: сприйняття; репрезентативні системи; модальність; канали сприйняття інформації; домінуючий канал сприйняття; модель сприйняття; інформаційно-комунікаційні технології.

ПСИХОЛОГО-ПЕДАГОГИЧЕСКОЕ ОБОСНОВАНИЕ СОЗДАНИЯ АВТОМАТИЗИРОВАННОЙ СИСТЕМЫ ДИАГНОСТИКИ УРОВНЕЙ РАЗВИТИЯ КАНАЛОВ ВОСПРИЯТИЯ (PERCEPTION.GUIDE)

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Аннотация. В статье описаны результаты исследования работ по изучению процесса восприятия информации человеком, определения основных каналов восприятия внешнего мира и диагностики преобладающего среди них. Проанализирован опыт и практические наработки учёных в разрезе психологии, педагогики, социологии, нейролингвистического программирования. Рассмотрены некоторые методики диагностики доминирующего канала восприятия информации человеком с помощью электронных ресурсов и программных комплексов. Представлена расширенная модель процесса восприятия информации человеком, на основании трехэлементной классификации типов личности: визуал, аудиал, кинестетик. Раскрыты основные этапы создания автоматизированной системы *perception.guide* для диагностики ведущего канала восприятия информации с целью выбора наиболее эффективных методов обучения с применением информационно-коммуникационных технологий. Определены преимущества использования системы в образовательных целях.

Ключевые слова: восприятие; репрезентативные системы; модальность; каналы восприятия информации; доминирующий канал восприятия; модель восприятия; информационно-коммуникационные технологии.

