The Study of Visualization in the System of Distance Education during the Pandemic: Psychological and Pedagogical Aspect

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Keywords: Visualization, Thought Form, Cognitive Construct, Learning, Learning Technologies, Digital Environment.

Abstract: The paper analyzes the current patterns of development of the cognitive sphere, describes the current issues of the use of modern technologies in education during the pandemic in the digital environment. The results of the study of the possibilities of using visualization in the training of employees of commercial organizations, which is based on active interaction and transformation of images, are described. It was revealed that the use of scribing, infographics, as well as a number of other patterns of the cognitive sphere allowed to significantly increase the effectiveness of training, motivation and involvement in the process. It was also shown that the data obtained confirm a number of works on similar topics conducted recently.

1 INTRODUCTION

The current situation in the world, which arose during the pandemic, has led to a change in key trends in education, shifting the focus to the online format. In addition, according to surveys and monitoring conducted by us since March 2020, many respondents (students of universities and institutes) noted that there are certain difficulties in perceiving and processing all the information received from teachers, linking this with difficulties adapting to the online format and increasing anxiety associated with the pandemic and concern for their health and emotional state.

All this led to the fact that there was a need to optimize the education system for the online format: to diversify the material offered as part of the training, to break it into small pieces, to do several forms of tasks within one lesson, so that attention would switch, the cognitive load on the entire material as a whole would decrease and its qualitative shift to the analysis of key materials would occur.

Among the urgent requests of modern systems (social work, public services from the state, the educational sphere) that work with information and

broadcast it to the world, including in digital format (due to the pandemic at the time of the study there were a number of restrictions), there was a request for staff training and the development of information materials in such a format that they are not only easy to read and perceived, but also their level of memorability would be significantly higher.

In addition to changing the perception and processing of information, in general, people's consciousness is changing, a "digital self" appears, based on the adoption of cultural norms and values in a digital, network format, on the perception of their personality through the prism of social networks, digital content and the speed of information dissemination. Current trends and research suggest that the "digital Self" is increasingly coinciding and less separated from the "real Self" of a person. The "digital Self" is currently being formed haphazardly, the patterns of its development and manifestation have not yet been revealed, there are no clear ideas about the specifics of communication and socialization of a person in the network, their impact on his psychosocial development.

All this speaks of the necessity and relevance of analyzing and identifying patterns that will, on the one hand, determine the features of the formation and

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development of the "digital self" of the individual, and on the other, identify the features of interaction with the "digital Self" at the level of perception and processing of information from that new world, the "bifurcated culture" (digital and real) in which the modern individual lives.

2 METODOLOGY

In modern research, the focus is increasingly shifting to the development and study of systemic models of cognitive activity – a complex of active actions that a person does to obtain and assimilate new knowledge and important information for him.

Modern information in the digital environment is nonlinear, therefore, on the one hand, cognitive processes remain the same and obey the laws of development in ontogenesis, on the other hand, they require constant involvement of various sensory, perceptual and cognitive processes simultaneously or in some unsystematic order.

There are some features of the cognitive sphere of a modern adult that can be noted:

- theoretical thinking is being used less and less, being replaced by practical thinking aimed at solving specific tasks, individual intellectual operations are turning into a system that is increasingly focused on one-time goals of a short time period, abstract reflections are becoming less and less. Many people still have a "rectangular logic" that is relevant for adolescence: there is a desire and motives to talk about some issues, but at the same time there are no developed skills to conduct a discussion, give arguments, and most importantly - to find them in competent sources of information, which leads to a lack of logic, correlation of causes and effects;
- the area of interest, on the one hand, is quite wide, but at the same time it is very superficial, often without diving into the essence of the issue. Social, moral, political, psychological and health issues are becoming more and more relevant for people. But at the same time, the "imprinting effect" is increasingly triggered: what I read first and liked, then it's true, then I like it;
- the level of assessment of one's intellectual abilities is growing (this is reinforced by the illusion of the availability of information in the digital environment), but at the same time the level of adequacy of this assessment is getting lower, since modern man equates the existing

ability to "scan diagonally" information on the Internet to data mining and processing. Consequently, the level of overestimation of their intellectual abilities has increased significantly;

- the digital environment (often purposefully) forms an illusory representation of the ease of certain aspects of life (a way of making money, creating a business, buying expensive things on credit, freelancing), the imagination of a modern adult easily "completes" certain aspects, fits itself into this world, overestimating its strength and cognitive resources. At the same time, the Internet creates cognitive distortions: "information is easily accessible", "press the button and you will get the answer to all questions", "buy a course and become a millionaire". All this leads to subsequent breakdowns, an increase in anxiety and a decrease in motivation to do something, and even more so to study;
- the development of perceptual processes is also changing: very often, attention and detailed perception of an object or situation focuses not on what is significant for a person, but on what the Internet, the digital environment offers, based on their own goals (shopping, developing consumer or electorate loyalty). The beauty and attractiveness of images is becoming increasingly important, rather than their critical comprehension;
- as for mnemic processes, their quality is also significantly reduced and transformed to meet the requirements of the modern environment: either memorization is situational and involuntary, or turns into attempts to memorize and mechanically memorize the necessary information.
- the focus of the "use" of imagination is no longer connected with intellectual activity or creative processes, but with an attempt to imagine oneself in an updated "artificial" non-existent life, the appearance of which is associated with a low level of the possibility of satisfying needs, interests, as well as an externally imposed value system. The imagination becomes less productive and more and more reproductive, - processing and creating attractive pictures from the outside;
- the development of speech is also changing: the use of complex sentences, metaphors, phrases is used less often, sentences are becoming shorter and more concise. Written speech is also impoverished and often the expression of

thoughts and ideas is replaced by the use of pictograms (emojis).

▪ attention is becoming "ill-mannered" (D.Hamilton): it is increasingly difficult to focus on something for more than 10 minutes, switchability has become higher, as well as distractibility. The level of observation and contemplation has decreased, which is facilitated by constant stimulation from the digital environment.

All the patterns described above lead to the formation of a new individual style of cognitive activity – a system of individual characteristics of perception and processing of information, which is based on individual experience of obtaining and analyzing data from the surrounding and digital environment.

Due to the non-linearity of the information received, it is necessary to take into account the peculiarities of its processing, analysis, memorization and evaluation. The model of nonlinear cognitive presentation of information in a digital environment is based on the active interaction of a person with perceived images, and not just their perception and an attempt to remember. To do this, you need:

▪ reasonably and competently offer applications and various technologies for use (especially those related to training), with the opportunity to test, try them, evaluate their effectiveness for personal use;

▪ use visual forms not only to provide information, but also to track all the changes and progress that have occurred during training, on the basis of which possible development trajectories can be predicted;

▪ when using non-linear information delivery, it is important to take into account the personal characteristics and values of the student, since when "scanning" information from the digital environment, the student's attention focuses on what matters to him and meets his value orientations.

The model of nonlinear cognitive presentation of information in a digital environment is a whole cluster of structural and functional relationships between a person who perceives, analyzes, processes and remembers information, the information itself, those who broadcast it and the ways (in our case visualization) of its transmission and explanation.

The transformation of information into thought forms of the inner picture of the world takes place according to the following algorithm: "scanning" information on the web, stopping and focusing on the necessary and interesting, active interaction with it

(for what it can be useful, how to use it), hypothetical or real application of it in life, "fitting" into the inner world of the individual in the format of thought forms.

Thus, the digital environment becomes a simulator for the development of a new cognitive model of perception and processing of information, which leads to the use of new resources for social transformation of the individual, including in the online learning system during the pandemic. The cognitive sphere gains flexibility, versatility and allows you to focus more clearly on the main thing and be less distracted by secondary moments related to learning. All this is connected, among other things, with the possibility of using visualization in the educational process.

Visualization can be considered in several directions:

▪ a way of presenting information in the form of diagrams, pictograms, infographics, drawings, etc. for faster and clearer understanding and interpretation;

▪ active interaction of the personality and the mental image, which allows him to maximally "fit" it into the inner picture of the world, endow it with value and remember.

Theories of schemes by R.S. Anderson and F. Bartlett and the theory of frames by C. Folker, M. Minsky describe visualization in a productive way: as a way and result of the transformation by a person of mental images of the inner world into a way of communication with the outside world due to the most complete presentation of the data available in consciousness.

A.A. Verbitsky describes visualization in a process context: this is a person's ability to "collapse" the surrounding, including digital, reality to the size of a mental image, which becomes a schematic support for subsequent information with a similar subtext or content. The author divides "conditionally passive, visual" for perception images that have already been prepared in advance and "conditionally active, visual" images that need to be actively worked out by the individual, and perhaps even created in his inner world precisely by processing and comprehending information, endowing it with meaning and value, which will make it memorable. Transformation and unfolding of mental images outside are cognitive projections that are always embedded in the interaction of the subject and the environment, including the digital environment, and can be effectively used in the learning process.

All information perceived from the outside goes through the process of processing and combining into

schemes and networks, which gradually become larger, as well as branch out and allow storing information and data in the form of enlarged mental images, which are best amenable to visual translation into the outside world due to their cognitive complexity. In addition to all this, visual images, due to the rapid "folding" and "deployment" of information, allow it to be analyzed faster, evaluate the available data and predict the results obtained.

As part of the formation of an individual style of cognitive activity, a person goes through certain stages in development: from the indicative stage based on expressive emotional activity to the stage of creating semantic images (exclusively mental visual constructs) - the basis of the internal model of the external reality in its complex interrelations, semantic and cognitive integrity. This requires the development and regular use of visual thinking.

Visual thinking is the analysis and synthesis of information using visual data series, the ability to interpret and analyze images. The key ability of visual thinking is the ability to transform large amounts of data into a system of easy and understandable thought forms connected by a single unique meaning.

Thus, the external visual world appears as a multidimensional cognitive construct that is subject to processing and interpretation of its individual images to thought forms that are understandable and easily fit into the inner world of the individual. Any thought form is always a combination of visual thinking, imagination and previous personal experience.

Visual thinking, among other things, thanks to the possibility of recognizing and processing information, allows you to quickly learn and use information, which increases the cognitive satisfaction of the individual, her cognitive needs.

Thus, visual information is always more structured, has the most significant cognitive potential for evaluating and memorizing data. Mental images have not only cognitive, but also emotional potential, allowing you to enter into the inner picture of the world the data that the individual gives meaning and remembers. In general, in the modern environment there has been a shift from a verbal to a visual picture of the world. The visual picture of the world is more cognitively easy to perceive, more capacious and containing many different meanings, as clear and memorable as possible. Therefore, the tendency to use various visual forms in work and training is becoming more and more natural and permanent, since it provides an opportunity not only to perceive figurative information, but also to actively present it, interact with it, transform it in a way that is understandable to oneself.

The study was conducted on the basis of the training departments of a number of large companies in the Rostov region. A total of 214 employees took part in the study, 100 of whom were randomly assigned to the control group, and 114 to the experimental group. All respondents have a higher education, 67% work in their specialty, the average age period in the sample is from 32 to 46 years.

The study was conducted in the following order:

- at the first stage, the respondents of both groups were offered questionnaires to assess their desire to study, their interests and involvement in learning in principle;
- at the second stage, work was carried out with teachers in the experimental group: they were told about various forms of visualization of information so that students wanted to work with it, use it in professional activities (among the forms they used were: scribing, intelligence maps, infographics, sketching);
- at the third stage, as part of the planned training, teachers implemented the proposed visualization options and a number of other recommendations, which will be presented below. In addition, in the middle of the training, the respondents (experimental group) were interviewed again for involvement in the learning process and motivation;
- at the fourth stage, all the data obtained were systematized, the results of training and the results of the questionnaire were analyzed, general conclusions were made.

No manipulations were carried out with the control group, they were interviewed at the same time as the experimental group for motivation and involvement, but studied according to the traditional program.

Training recommendations offered to teachers, in addition to visualization of educational information:

- clearly formulate the purpose of the lesson and always link it with the practical activities of the respondents;
- use a "content grid": the information in the classroom should be diverse, contain examples and stories;
- the types of activities in the classroom should change each other approximately every 20 minutes, it is difficult to keep your attention longer;
- to link educational material with the sphere of interests of students;

- provide feedback after each module or block of information, focus as much as possible on the progress and positive results achieved;
- constantly use images and metaphors in the lecture material that should be emotionally significant for this category of students.

The entire training program (regardless of the subject of study) is based on active and purposeful work with visual data, their mental transformation and modification in order to consider information in the framework of training from different sides, taking into account many aspects that were not initially noticeable.

All the work on the implementation of a training system based on visualization lasted 8.5 months.

3 RESULTS

The data obtained for the control group are as follows:
- respondents are unenthusiastic about learning in 69% of cases before the start of training, in 66% in the middle of training and in 68% at the end;
- their motivation level is 4.5 out of 10 points at the beginning of training, 4.6 – in the middle and 4.4 - at the end;
- their level of engagement is 3.5 out of 10 points at the beginning of training, 3.3 – in the middle and 3.6 - at the end.

All data were processed statistically using the Wilcoxon T-test, no significant differences were found.

The data obtained for the experimental group are as follows:
- respondents are unenthusiastic about learning in 71% of cases before the start of training, in 42% in the middle of training and in 25% at the end;
- their motivation level is 3.9 out of 10 points at the beginning of training, 6.6 – in the middle and 8.1 - at the end;
- their level of involvement is 3.4 out of 10 points at the beginning of training, 7.4 – in the middle and 9.6 - at the end.

All data were processed statistically using the Wilcoxon T-test, significant differences were found in the degree of motivation (Temp>Tcr(0.01)), involvement (Temp>Tcr(0.01)), level of enthusiasm (Temp>Tcr (0.01)).

As for the teachers working in the empirical group, they were interviewed based on the results of their observation of the group during work. They noted the following:

- in the empirical group, respondents studied more willingly, helped each other, tried to immediately apply the data obtained in their work, often showed creativity in finding solutions, became more organized and independent, took the initiative in learning. They also began to read more professional literature. During testing, the HR department noted an increase in their innovation potential by 14%, some of the respondents began to offer innovative proposals. The level of self-organization has also increased;
- no such changes were detected in the control group.

As for the assessment of academic performance based on the results of training, it has changed in the experimental group (it has grown significantly), the number of errors in test papers and tests has decreased by 64%. No such changes were found in the control group.

4 DISCUSSION

The data obtained confirm a number of scientific studies and works on the psychological and pedagogical aspects of the use of visualization in teaching within the digital environment, when learning is implemented in an online format. Heidi Julien also notes that the development of digital literacy, skills of working with visual information is required for the most effective and ethical training of modern people of different ages (Heidi, 2016).

Gray, Jonathan; Gerlitz, Carolin; Bounegru, Liliana put emphasis on the fact that the effective data and information cannot be limited to vospriyatiem information needed her active processing and evaluation.

John. McDougall, M. Readman and F. Wilkinson focus that different visual technology in the digital environment allow you to develop and enhance the quality of interaction between students and teachers.

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