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Visualization in Learning as a Factor in the Development of Motivation for Self-education of Adults

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Abstract

The global trend of digitalization of all spheres of human life significantly changes the requirements for professional competencies of employees of modern organizations implementing the latest technologies. Digital technologies are constantly evolving, the total costs for them are growing, which means that the demand for workers with both digital technology skills and skills combining cognitive abilities and behavioral aspects is increasing. Realizing this, organizations are actively using employee training programs in the workplace. The data obtained during a series of surveys of over 350 employees who were trained at corporate universities or specialized centers were collected from 2019 to 2021, the results contain information about the problems of adult vocational training in the system of corporate universities or specialized centers: firstly, employees have a low level of motivation (there is no desire and emotional involvement in training); secondly, employees have difficulties with applying the acquired knowledge and skills in the practice of activities, and, finally, one of the key difficulties is a decrease in the level of application of the skill of processing and analyzing information that was presented as part of the training. All these survey data confirmed our earlier studies on the effectiveness of using visualization techniques as a form of working with information in the process of teaching people of different ages. In this regard, in this paper, a study of corporate learning processes based on visualization is conducted, which is an effective learning tool and contributes to the development of digital skills of employees.

Keywords: digitalization, digital skills, digital literacy, visualization, corporate training, information technology, e-learning, intellectual capital, adult education, modern educational technologies, student personality.

1. Introduction

In the conditions of constant evolution of digital technologies and progressive innovative development of organizations, employees should be able to adapt to new ways of organizing activities, in other words, develop existing skills and acquire new ones. Now it requires not only the ability to work with information technologies, search for and use the necessary information, create content, but also critical thinking, the ability to online cooperation and online communications, because the COVID-19 pandemic forced not only personal events to be transferred online in a short time, but also organizations to switch to remote work format (Ciarli, et al., 2021). As a driving force, digital technologies are changing the economy, creating new industries and spheres of activity, changing the internal environment of an organization in which intellectual capital is the

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basis of competitive advantage. Organizations are changing their business models by introducing digital applications, big data analytics, cloud technologies and others, while employees with the skills to work with these technologies are changing the organization of work and as a result, the organization is evolving. The necessary skills of employees that contribute to the digital evolution of the organization should include the ability to creativity and innovation, initiative, logical and creative thinking, the ability to manage organizational changes, readiness to gain new experience. (Sousa, Rocha, 2019). Realizing the need to increase the digital skills in demand, organizations strive not only to hire specialists with the necessary competencies, but also to organize corporate training of employees, using the latest technologies for this, one of which is visualization. Visualization in the corporate training system allows you to optimize the data perception system due to its structuring and clarity (the use of symbols, signs, sketching and infographics), maximize cognitive skills through constant work with abstract thinking, various forms of generalizations, which generates interest and the desire to apply the data in practice. Visualization as a form of data representation in the corporate training system allows you to analyze data as systematically as possible, easily explain all the changes made to the algorithms of work. The visualized data easily interprets the logic of any process, it is quite simple to manage them – to change and transform if necessary, in addition, they are reproduced as simply and accurately as possible in any new environment.

The need for visualization of educational information is dictated, among other things, by the fact that modern adults are maximally focused on visual perception, therefore, difficulties arise in processing information during the educational process, which leads to an increase in errors and a decrease in the percentage of those who completed training and passed the final exams. The depicted data makes any information much more accessible and understandable, since the visualization format can be very diverse – graphs, diagrams, infographics, posters, videos, intelligence maps, pictographic images, diagrams, visualized instructions and collages. Visualization allows the materials provided to students to be reflected in dynamics and interrelation, which also contributes to their more complete assimilation. From the point of view of the teacher, among the key goals of visualization in corporate training are the following: correct and clear presentation of the material, compliance with the formal logic of presentation of data or algorithms of work, management decisions, as well as the use of visualization of information for interpretation or explanation of the text, data structuring.

Also, the teacher studies in more detail all the data that needs to be presented in a visual format, which allows him to analyze the material more deeply from new points of view and aspects. From the point of view of the student, among the key goals of using visualization in working with educational information are the following: clearer and deeper analytical work on the topics discussed, the search for common points of intersection among different opinions, theories, approaches. In addition, any imaginative information (when images and signs are invented by the student himself) makes it possible to better assimilate information, store it in long-term memory and fit it into the inner picture of the world. Visualization maximally contributes to the in-depth study of any innovative ideas by students, helps to present them to others, understand them at the level of logic, accept them at the emotional and value level. It is visualization that allows you to "grasp" the key points of ideas, learning in general, the possibility of applying the acquired knowledge and skills in practice, and also allows you to maintain concentration and focus of attention by maintaining interest. Visually presented data makes it easy to switch from one discussed issue to another, which also increases the effectiveness of training.

Currently, there are quite a large number of ways to use visualization and explain its effectiveness in terms of obtaining the final result in the form of the possibility and desire to apply the acquired skills and knowledge in work practice. Nevertheless, nowadays adult education is becoming more individualized, the "pedagogy of subjectivity" is becoming relevant, when it is important to build a route and trajectory of learning taking into account the individual characteristics of information processing. Naturally, it is impossible to take into account all the individual characteristics and adapt to each student, but there are current trends in working with visual information and using visualization, taking into account the style of thinking and the specifics of mental representations ("casts of information").

Also, the use of visualization during training allows teachers, trainers to prepare and explain the material more efficiently, especially if it is overloaded with diagrams, algorithms, complex terms and abstract systems.

Thus, the analysis of the personal characteristics of students will allow, on the one hand, to use visual material more efficiently in teaching, on the other hand, it will increase the proactivity, awareness and degree of motivation of students and teachers.

2. Materials and methods

The research materials devoted to the use of visualization in adult education in the corporate education system as a technique that promotes the development of their desire for further self-education are based on a number of theoretical positions, the analysis of which contributed to the selection of materials and the construction of the logic of the study.

1. The hierarchical theory of successful intelligence R. Sternberg ([Sternberg, 1996](#)), which includes a combination of analytical and practical abilities and creativity. Successful intelligence allows a person with an active position to transform and adapt the environment to achieve their goals. The criterion of successful intelligence is the presence of significant personal achievements due to the use of one's intellectual potential. The author describes intelligence from three interrelated positions: the inner world, the existing empirical experience and the external selective context, which allows to correlate the experience and positions of the inner world with external conditions.

2. The theory of mental representations by A.P. Lobanov ([Lobanov, 2010](#)). The author notes that human intelligence is a mental experience that allows you to organize mental representations of varying degrees of complexity and formation. This is a system that exists in dynamics, based on mental representations, which are organized as dynamic systems that can be activated by external conditions (cognitive tasks) or internal cognitive experience (curiosity, the desire to learn new things). Which leads to variability in the cognitive strategies used.

3. R. Gregory's ideas ([Gregory, 1970](#)) that perceptual constructs arising on the basis of polysensory and mnemonic are combined into independent constructs that influence the possibilities of application and development of intelligence.

4. The mechanisms of perceptual learning, highlighted by E. Gibson ([Gibson, 1975](#)): abstraction, filtering and indirect mechanisms of attention. The analysis and differentiation of promising constructs are carried out by abstracting (generalization of the received information into mental constructs) and filtering (separation of insignificant information). Indirect attention mechanisms allow you to keep focus on a specific object, subject, task. There are three components of perceptual learning: active perception, action and cognitive (research) activity. Perceptual learning and development are connected due to the fact that the subject of learning develops the ability to independently extract the necessary information from experience and thereby learn in the future. Learning through perception allows the student to receive information in the format of completed perceptual constructs and to learn in the form of assimilation of a certain mental experience through observation. This allows you to learn specific concepts and algorithms, which is relevant for corporate training, which is often implemented in the format of specific instructions, which is significant for a person, since he often thinks within specific categories.

5. Ideas of A.N. Leontiev ([Leontiev, 2000](#)) about the development of personality. The formation of the trajectory of a person's individual development is determined by his effective connections in the environment: the ability to establish contacts, hear the interlocutor, work in a group, «read» the nuances of what is happening in the environment, as well as the ability to implement existing practical experience and norms of behavior in various situations.

6. V.I. Andreev's concept ([Andreev, 2013](#)) self-development-oriented learning is based on the idea that any educational processes should, first of all, be based on students' awareness of their value and significance, understanding of the unlimited personal and professional potential, on the possibility of realizing it within the framework of creative freedom. The author calls self-management, self-knowledge and the ability to interact with the educational environment one of the basic criteria of self-development. Andreev notes in his works that at certain moments of accumulation of quantitative changes in the personality's «I» after interaction with the external environment, a qualitative transition occurs, after which the development of the personality, its desire for learning, cognition, interaction begins to be determined by itself, its internal conditions and needs.

7. The concept of self-education by T.V. Minakova ([Minakova, 2008](#)) it contains the idea of the presence of a number of conditions that contribute to its appearance:

– the formed basic level of cognitive skills that allow you to solve a wider range of tasks, variability of goals and results obtained within the framework of training;

– diversity of values: a wide range of conscious motives, among which the expressed one is the motive of achievement; the value of learning itself; the value of developing independence in cognition;

– the dominance in the learning process of situations of independent critical analysis of data, search for solutions, especially in situations of lack of information, as well as the ability to build students their own educational route independently.

Visualization as a form of corporate training allows you to assimilate various opinions, ideas, systems and algorithms as quickly as possible, as well as find a common language with other participants (when studying in microgroups). In addition, visualization is an easy way to provide students with feedback and show the degree of their progress in learning, as well as the level of assimilation of the material. All this leads to the formation of a key skill that is necessary for self-realization in professional activity – self-education.

Personal self-development is a result of corporate training (as a private factor) that allows a person to consciously change qualitatively in the existing conditions of professional activity, clearly realizing their goals, values, attitudes and ideals that lead to the growth of personal competitiveness and efficiency in work through, among other things, creative and non-standard solutions to typical situations in activities.

As a result of the analysis of theoretical concepts, ideas and current research of the adult education system, a study was conducted aimed at studying the personal characteristics of students in the system of corporate education based on visualization, which are associated with its effectiveness and the emergence of a motive for self-education.

The object of research: the system of personal characteristics in corporate training.

Subject of research: personal aspects of the development of the motive of self-education of students based on the use of visualization in the learning process.

Research hypotheses:

– aspects of the emergence of the desire for self-education of students in the corporate training system are: motivational (development of internal motivation, the presence of a pronounced motive for success), as well as personal (a high degree of personal competitiveness, a sufficient level of self-acceptance, orientation to the formation of professional competence) and interpersonal (the ability to show cooperation in teamwork, dominance in communication with a pronounced friendliness);

– when using visualization in the corporate training system, its effectiveness increases and the desire for self-education manifests itself.

Research objectives:

– to select diagnostic methods for individual aspects of the desire for self-education, as well as to conduct a self-assessment of the effectiveness of training and the desire for self-education in groups where visualization techniques were a priority form of training and where there is no;

– to measure various motivational, personal and interpersonal aspects of the desire for self-education, stated in the hypothesis;

– to identify the interrelationships and differences between the manifestations of these aspects of the desire for self-education among students in groups where visualization techniques were a priority form of learning and where they are not.

The study was conducted on the basis of diagnostic results of adults who were trained during the year at the place of work in training centers that exist in organizations. 94 people were interviewed, 50 men and 44 women, all have higher education, work in organizations and are trained there. 4 organizations participated in the study, each with more than 500 employees, and has its own training centers. Two organizations used mainly visual technologies as part of the training, while the other two did not.

Stages of the study: selection of methods for the diagnostics of all respondents, preparation of a questionnaire to assess the desire for self-education and the effectiveness of training; diagnosis of respondents; implementation of corporate training for 3 months according to different programs (some respondents had visualization as one of the dominant forms of training, the other part did not); re-diagnostics in order to evaluate hypotheses put forward earlier.

Within the framework of the study, the following methods were used, which made it possible to analyze the individual personal parameters of students: a test for studying behavior strategies; a

method for diagnosing interpersonal relationships; a test of socio-psychological adaptation; a method for diagnosing professional activity; a test for diagnosing motivation for success, a test of "Career Anchors".

3. Discussion

A study of the literature on corporate training issues shows that every year the need for organizations to implement digital transformations increases, which requires updating the digital skills of their employees, who need to manage their careers as best as possible in order to remain in demand (Egorova, 2022). Modern studies of the problem of what skills and abilities are needed by employees of organizations show the existence of a connection between the level of digitalization of the industry and the perception of technological changes by employees as opportunities for personal growth (Ostmeier, Strobel, 2022). Taking into account the promising trends of technological development, the most demanded skills of employees are over-subject skills, for example, problem-oriented thinking, the ability to act in conditions of uncertainty, emotional intelligence. In addition, meta-competencies are needed: flexibility, adaptability, the ability to self-development and lifelong learning. It also requires supra-professional skills, such as systems thinking, working with artificial intelligence and other digital technologies, the ability to work in a team, the ability to be creative. The development of corporate staff training models within the boundaries of the digital transformation strategy of the organization will contribute to the individual independent development of the necessary skills, strengthen the desire of employees to actively improve themselves. Modern organizations are constantly improving their corporate training programs in the direction of developing not only digital skills, but also other professionally oriented skills that contribute to improving organizational efficiency (Barthakur et al., 2022).

The relevance of the development and use of corporate training programs to improve staff skills is confirmed by the fact that on-the-job training programs are closely related to the practical activities of a particular organization, while training programs and technologies used in the formal educational environment do not take into account some opportunities for integrating work and training. The applied technologies of on-the-job training focus on the professional context in which the training takes place. Modern intellectual learning tools are precisely aimed at creating and developing a knowledge structure in the workplace and improving corporate training programs so that they are suitable for both beginners and experienced employees, developing the necessary skills (Ley, 2020).

Corporate personnel training programs should be balanced, and focus primarily on the skills that the organization needs in the first place. To do this, it is necessary to compile a list of skills that need to be taught, select those employees who need training first of all and select effective training methods based on digital technologies. For example, the perception and analysis of visual information in the learning process, in addition to the development of professionally oriented skills, also improves digital competence, as visual technologies are becoming more developed and complex. When choosing a corporate training method, the main criterion is the effectiveness of the chosen method, and given that the skills associated with the introduction of the latest technologies are the most in demand, it means that the training methods should also correspond to the trends of digitalization. The use of e-learning has become the first step towards the digital transformation of learning.

Online courses, virtual reality, augmented reality technologies, gaming technologies, visualization are actively used. The advantages of e-learning in corporate training are the availability of technologies, convenience, and opportunities for individualization, and the disadvantages may be related to the organizational difficulties of a particular organization and are insignificant (Kimiloglu et al., 2017). This is confirmed by the fact that despite the different intensity of e-learning in various fields, the global corporate e-learning market is growing rapidly. Thanks to the possibilities of co-education in a problem-oriented environment, online technologies have become quite popular (Saleh et al., 2022).

Modern technologies of asynchronous online discussions have proven their effectiveness not only in the academic sector, but also in corporate learning processes. Online discussions successfully involve all employees in the joint execution of tasks, as a result of which, in addition to creating a new product, new knowledge is jointly formed, the intellectual potential of the organization increases, and the basis for the transition to a qualitatively new level of cooperation is created (Schaefer et al., 2019).

Another technology that can be useful in corporate training is visualization technology, which is the basis of virtual and augmented reality. Virtual reality technology is the most effective way to improve practical skills that are in demand in the digital age, for example, the ability not only to receive information, but also to transform it. The advantages of using virtual reality by universities are the ability to simulate real production situations simulating work processes, then graduates receive not only theoretical knowledge, but also practical skills. The use of virtual reality in corporate employee training contributes to the involvement in the learning process, the development of critical thinking, and also reduces training costs (Matsika, Zhou, 2021).

The effectiveness of virtual reality as a technology for corporate training is also due to the fact that it helps to overcome the difficulties of motivation, concentration on the part of the trained personnel, who, due to age characteristics, lack confidence or basic knowledge. The employees participating in the research noted that they are often distracted, it is difficult for them to focus on voluminous texts, they have a growing sense of anxiety when they see large theoretical materials that need to be processed and thought about independently. Augmented reality technology can make the corporate learning process more informative and interactive.

This technology helps to develop conscientious work skills, achieve better results through visualization and full immersion in the problem area, it can be applied to various subject areas, developing professionally oriented skills. The experience of using this technology for training shows that it is well used both in an educational organization and in the workplace, it is equally effective for different age categories and in various industries (Christopoulos, et al., 2022; Hekele, et al., 2022; Roopa, et al., 2021).

The analysis of the literature showed the interest of scientists in the problem of using digital technologies in teaching. Online learning, virtual and augmented reality are studied a lot. A limited amount of research is devoted to corporate training and on-the-job training. There are not enough publications devoted to the use of visualization techniques in the learning process in general, and the use of this technology in corporate training, in particular. Nevertheless, it is obvious that training using data visualization allows you to: combine formal and informal methods of work and assimilation of knowledge, mastering skills; maximize creativity and emotional involvement in learning; combine visual presentation and a high degree of fullness of data and information in a concise form. Given the undeniable advantages of visualization, this study examines how the perception and processing of visual information increases the effectiveness of a corporate training program.

4. Results

Respondents who participated in the study of personal characteristics of students in the system of corporate education based on visualization, related to its effectiveness and the emergence of a motive for self-education, were differentiated into two groups: those who studied effectively and rated their desire for self-education as high and those who studied less effectively and rated their desire for self-education as low.

The analysis of changes in the level of learning effectiveness and evaluation of the desire for self-education after were based on the following parameters:

– individual parameters: motivational (development of internal motivation, the presence of a pronounced motive for success), as well as personal (a high degree of personal competitiveness, a sufficient level of self-acceptance, orientation to the formation of professional competence) and interpersonal (the ability to cooperate in teamwork, dominance in communication with pronounced friendliness);

– parameters directly related to the effectiveness of training and the emergence of the desire for self-education: a small number of mistakes made; the implementation of at least 50 % of independent individual projects and group assignments; the absence of conflict interaction during group work; the manifestation of initiative when offered to join additional research practical projects; the development of additional competencies within the framework of the activity.

Changes in the parameters that showed shifts in the effectiveness of training, as well as individual parameters were the basis for testing the hypotheses put forward.

Prior to the implementation of the training programs, the analysis of parameters related to the effectiveness of training made it possible to differentiate all respondents into two groups with varying degrees of severity of the effectiveness of training and the emergence of a desire for self-education:

– a group with high learning efficiency and an assessment of their desire for self-education as high (29 %): a small number of mistakes made; implementation of at least 50 % of independent individual projects and group assignments; absence of conflict interaction during group work; taking the initiative when offered to join additional research practical projects; development of additional competencies within the framework of activities;

– a group with low learning efficiency and assessment of their desire for self-education as low (71 %): a large number of mistakes made; implementation of less than 25 % of independent individual projects and group assignments; presence of conflict interaction during group work; low level of initiative when offered to join additional research practical projects; low level of development of additional competencies in as part of the activity.

The number of respondents with a low level of efficiency in training and lack of desire for self-education is 71 %, which indicates a low effectiveness of educational programs. Consequently, there is a need to change them from a methodological point of view, taking into account the individual characteristics of the respondents.

As for individual parameters, in the two groups described above, the most pronounced among them are:

– in a group with high learning efficiency and an assessment of their desire for self-education as high among individual parameters, the following are expressed: high internal motivation, a high level of motivation for success, as well as a high degree of personal competitiveness, a sufficient and adequate level of self-acceptance, a pronounced orientation towards the formation of professional competence, the ability to cooperate in teamwork, dominance in communication with pronounced friendliness;

– in a group with low learning efficiency and an assessment of their desire for self-education as low, the following are expressed: low internal motivation, low level of motivation for success, low degree of personal competitiveness, insufficient level of self-acceptance, lack of orientation to the formation of professional competence, low level of ability to cooperate in teamwork, dominance in communication with low friendliness.

All these results confirm the first hypothesis that the aspects of the emergence of the desire for self-education of students in the corporate training system are: motivational (development of internal motivation (remp = 0.229), the presence of a pronounced motive for success (remp = 0.112), as well as personal (a high degree of personal competitiveness (remp = 0.106), a sufficient level of self-acceptance (remp = 0.211), orientation towards the formation of professional competence (remp = 0.114)) and interpersonal (ability to show cooperation in teamwork (remp = 0.104), dominance in communication (remp = 0.178) with pronounced friendliness (remp = 0.203)).

A high level of efficiency in learning (remp = 0.125) and the desire for self-education (remp = 0.138) are directly correlated with all the parameters listed in the hypothesis at a significance level of 0.01.

To test the second hypothesis that when using visualization in the corporate training system, its effectiveness increases and the desire for self-education is manifested, different training formats were implemented for respondents – with and without visualization. The training was implemented in the format of mini-lectures, round tables, interactive sessions, but at the same time some respondents actively used visualization, while the other part did not.

Repeated diagnostics was carried out only among respondents who, before the training, were in a group with low learning efficiency and an assessment of their desire for self-education as low, 71 % of them were among the respondents. After repeated diagnosis, two key parameters were measured: the effectiveness of training and the assessment of one's desire for self-education. Out of 71 % of respondents, the effectiveness of training and the assessment of their desire for self-education increased in 54 %, namely:

- the effectiveness of training (was low in 73 %, remained low in 11 %)
- assessment of their desire for self-education (was low in 69 %, remained low in 7 %).

All the differences were checked using the Mann-Whitney criterion, the differences are significant at the level of 0.01.

5. Conclusion

The significance of the research is quite high in the applied aspect: the use of visualization helps to develop the effectiveness of adult education in a corporate format, as well as to develop

their desire for self-education (proactive attitude in training, high internal motivation, conscious choice of courses and programs, the desire to apply them in practice).

The conducted work has shown that the skill of self-education is formed only if the teacher and the student are interested in the educational process to the same extent. The activity of a subject who is capable of self-education can be described using four main parameters: independence, objectivity, joint participation and creativity. These key parameters can be developed using visualization, which is based on various personal characteristics of participants in the educational process.

It was revealed that the process of self-education begins to form from the moment of understanding one's own goal as meaningful, easily presented in the format of a visual image, emotionally colored and meeting the values of the individual. This leads to the formation and maintenance of a strong-willed effort that allows you to focus attention and support actions to achieve the goal. Self-education leads a person to the fullest possible disclosure of potential, taking into account all her abilities and capabilities. All this is aimed at the appearance of a motive for a person's self-realization in life, in general, and in professional activity in particular.

Among the personal parameters, the effectiveness of training and the desire for self-education are determined by: high internal motivation, a high level of motivation for success, as well as a high degree of personal competitiveness, a sufficient level of self-acceptance, a pronounced focus on the formation of professional competence, the ability to cooperate in teamwork, dominance in communication with pronounced friendliness.

The hypotheses of the study were confirmed, the purpose of the study – to study the personal characteristics of students in the system of corporate education based on visualization, which are associated with its effectiveness and the emergence of a motive for self-education – was achieved.

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