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Cognitive Approach: Methodology Development in the Era of Digitalization

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Abstract

The actuality of this article is caused by the information revolution at the present period of social development, where digitalization is becoming a key element. The position of completely different way of knowledge generation with a setting on effective use of knowledge via means of the individual system of competences, including competences of student's cognition in the digital world is defined. The authors reveal cognitive theories of teaching which act as psychological and pedagogical foundation for the didactic systems, realizing values of cognition and development of students' cognitive abilities.

The purpose of the article is to consider the appearance of a new direction in education – “cognitive pedagogy”, aimed at transforming processes of teaching and upbringing in the context of formation of human's cognitive and personal structures.

The author's methodology, supporting the development of cognitive approach, has been proved: information-cognitive and social-cognitive approaches and human-conformity, chronotope, fractality, and iteration principles. The authors substantiate cognitive pedagogy as an integral unit of psychological and pedagogical sciences with person-oriented focus of education, and as a reference point on formation of a cultural and semantic basis of education subjects' worldview, and the generation of subject, pedagogical and scientific knowledge.

Authors have substantiated “cognition” in all pedagogical aspects, such as human's development, didactics, university management, which acts as an ability to reprocess new information and generate knowledge.

The practical value of the research results, presented in this article, is in the possibility of cognitive approach implementation, while solving problems of processing, reconfiguring of information and generation of knowledge, taking into consideration human's cognitive opportunities (perception, representation, cognition, understanding, explanation).

The article is intended for researchers, teachers, psychologists, and students.

Keywords: cognitive theories, cognitive pedagogy, digitalization, cognitive and personal human's structures, cognitive approach.

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Introduction

It is necessary to outline the main aspects in digital transformation of the world: they are fundamental changes in an activity paradigm, stereotypes of the way of thinking, methods of pedagogical work, and management. From a stand point of educational systems, the directions of research in the conditions of digitalization are defined: digital literacy and digital ethics of subjects of education; organization of educational environment and pedagogical interaction of the subjects of education. However, according to the authors' scientific opinion, the problem of overcoming barriers between educators and learners (a teacher and a student) as representatives of the "analog" and "digital" world with completely different perception, way of thinking, demands to information, abilities to its processing, new culture and innovative mechanisms of communications is a matter of priority.

Higher education institutions can become the "drivers" (initiators) of high-quality changes of the educational environment as they accumulate educational and scientific potential most comprehensively. However, in order to achieve the common goal – formation of new digital educational environment – the university needs to provide the following:

- creation of innovative conditions for student's development via means of digital technologies capacity;
- implementation of digital technologies in the educational process of higher school not only as tutorials, but for the purpose of formation of logical and algorithmic way of students' thinking;
- teacher training and professional development of pedagogical personnel on the implementation of digital technologies in the educational activity;
- increase in level of motivation for professional use of digital technologies by teachers;

- accumulation, systematization, and dissemination of information on implementation of digital technologies by the educational institution for development of managerial opportunities.

The foundation of the research is synthesis of philosophical, psychological, pedagogical and humanitarian approaches for development of a cognitive basis of an educational activity, promoting research of educational systems, pedagogical objects (phenomena) and pedagogical situations.

Purpose and objectives of the study

Purpose of the study is to consider the appearance of a new direction in education – “cognitive pedagogy”, aimed at transforming processes of teaching and upbringing in the context of formation of human’s cognitive and personal structures.

Literature review

An important element in the link of cognitive pedagogy is a cognitive theory of management (Tsvetkov & Soloviev, 2016; Levina, 2018) and cognitive theories of teaching as a means of new knowledge reconfiguration, realized in values of cognition and development of students’ cognitive abilities (Solso, 1996; Dunlosky et al., 2013; Bershadskaya & Bershadskij, 2016; Kamaleeva & Mukhametzynova, 2019).

Digitalization at all significant areas of activity, including education system, becomes a result of information revolution at the present period of social development. At the same time, digitalization acts not only as an instrument for the educational process, but, first of all, as the new environment including all elements of a complete ecosystem (Barak, 2018; Bond et al., 2018; Levina, 2019).

The cognitive methodology, investigated by the authors, represents the synthesis of the philosophical, psychological, pedagogical and humanitarian approaches to development of an integral basis of educational activity, stimulating research of functioning and development of educational systems, pedagogical objects (phenomena) by means of modeling of term, procedural, structural and substantial or conceptual characteristics of teaching and learning process and pedagogical situations (Gil`meeva et al., 2019).

Cognitive theories of teaching act as an important link of cognitive pedagogy. They realize values of cognition and development of students’ informative abilities when teaching is carried out with a support of first-hand students’ experience, its enlargement in the process of search, and research activity, active learning of the knowledge system (Kamaleeva & Gruzikova, 2018; Kamaleeva, Mukhametzyanova & Nozdrina, 2019).

Indeed, such authors as Sergeev, Bershadsky, Chorosova et al., in the monograph “Cognitive pedagogy: technologies of e-learning in teacher’s professional development” (2016) note that in modern conditions of implementation of modern ICT-technologies and teaching programs in the practice of higher education, in the process of providing pedagogical interaction and feedback according to its results as external forms of the environmental organization for teaching and educational interaction, “it is forgotten that these subjects reflect only external forms of environmental organization of teaching and educational interaction, while the essence of learning processes is kept aside” (p. 4).

An important aspect for transferring knowledge and competence formation within a university is the following aspect – a problem of Human’s development (Mukhametzyanova, 2019), traditional for the Russian pedagogy – an address to the personality via means of humanitarian pedagogical practice and upbringing effect of the higher education, and, on the contrary, a problem of strategic management in the universities as educational corporations in the education market, more typical for the Western world. These two aspects define “opposite” positions of personal and management approach to the higher education development, and the didactics strives to counterbalance them due to creation of teaching formats.

Methodology

Appearance of digitalization era on the basis of ICT-technologies and development of “economy of knowledge”, where information and knowledge take the leading position and production of new goods, technologies and services is a source for economic growth, implies a new educational paradigm for development of productive force – human’s capital.

The position of completely different way of knowledge generation, with a setting on effective use of knowledge via means of individual system of competences, including competences of students’ cognition of the digital world, but not only digitization of information resources in the framework of traditional education is meant. A problem about “convergence” of a modern student’s system of cognition and traditional system of information transfer and competence formation within higher education is still open.

Authors actualize the process of cognitive pedagogy creation as an integral unit of psychological and pedagogical science with a person-centered focus of education, and as a reference point for formation of a cultural and semantic foundation of education subjects’ worldview, a generation of subject, pedagogical and scientific knowledge by means of didactics development in the conditions of digitalization.

Cognitive pedagogy, according to authors’ scientific opinion, represents a complex of scientific knowledge which is based on research and cognition of essential characteristics and internal inter-

connection of psychological and pedagogical objects, phenomena and processes and promoting realization of a key idea – an idea of personal, organizational-pedagogical, and system development of a human within an education system.

Methodological foundation of cognitive pedagogy is cognitive approach and its modern interpretations, where the term “cognition” acts as an ability to process new information and generate knowledge, and becomes the leading characteristic and a basic resource of the personality.

Cognitive approach got its birth in psychology, being based on empirical study of human’s way of thinking and various processes of perception of the outside world, and its internal broadcasting by the human in his(her) own “images” and representations. Its interconnection with pedagogy is revealed in the accent on processes of obtaining information, transformation and generation of new knowledge within an educational activity. In the course of teaching, there is formation and development of the informative structures of the personality causing dynamics of human’s personal and professional qualities development as well as management of educational situations, processes, educational organizations and systems from the stand point of preservation, transfer and generation of knowledge in the era of digitalization (Balota & Marsh, 2004; Sergeev, 2010; Abramishvili et al., 2017; Kholodnaya, 2018).

The appeal to the cognitive direction as a form of reconfiguration of all types of cognition of the surrounding world is considered to be of principle. As a famous researcher of cognitive psychology, Robert L. Solso (1996) wrote: “It is important, how people obtain information about the surrounding world, how this information is transferred to the person, is kept in memory and will be reconfigured into knowledge, and how this knowledge affects our attention and behavior” (p.28).

Cognitive approach is a theoretical and methodological strategy directed on the problem solution of processing, re-configuration of information and generation of knowledge taking into account human’s cognitive capacities (perception, representation, cognition, understanding, explanation), reflecting the cognitive organization of subjects and objects of education.

The cognitive approach causes the following phenomena within pedagogy:

- - person-centered focus on educational process;
- - knowledge priority as the “heart” of education and formation of the mechanism of knowledge generation in the result of it;

- - “convergence” of representation and perception of “education” as multidimensional information flows, i.e. transformation of organizational and pedagogical management of processes of teaching, upbringing and development with increase in correlation of “target” and “receiver” of information.

Cognitive approach should be treated in terms of its applicability to various directions of functioning of modern educational systems. Each type of activity within educational process imposes restrictions to the form, maintenance, and applicability of “cognition”. Objectively, various actions with pedagogical objects and subjects of education form their own system of signs and principles of realization.

Realization of cognitive approach presupposes development of mechanisms for the image of objects of knowledge formation as enough steady models and the methods serving as foundations for the educational activity at all spheres of life in the era of digitalization.

Results

We suggest that development of cognitive approach is caused by the following problems:

- 1) how to keep and develop uniqueness of a person and provide him (her) with mechanisms for life support and existence in the era of digitalization;
- 2) how to provide transfer of science-rational and socio-cultural layers to the “digital generation”, who is hard at perceiving fundamental interconnection of science and culture;
- 3) how to use multidimensional opportunities of digitalization in management of educational processes and educational subjects efficiently for improvement of education quality.

According to authors’ opinion, the term “knowledge”, used here, is multidimensional – “human’s knowledge” and its features (individual development); “knowledge of science” (maintenance of subject matters as bases of professional development); “knowledge of didactics” (organization of effective teaching process in the university); “knowledge of management” (sets of regularities, interconnection, organizational interaction, and monitoring of university activity). Despite a variety of the directions, a human and his (her) abilities to perform an action within an educational system are taking a central place in the range of described activities. It dictates the need for identification of *individual cognitive instruments of cognition*, whose functions perform concepts (steady personal and value characteristics) acting as an effective integral mechanism, providing efficiency of didactic regulative development.

According to authors' opinion, *cognitive management* is represented as an activity of the managing structures to processing of organizational and pedagogical information for the purpose of regularities identification of the issued educational processes and their implementation in practice of management of educational situations, processes and organizations. The cognitive didactics uses the principles and concepts, traditional for didactics, but it reconfigures and supplements them, adopting for modern realities of higher education: it doesn't not only impart knowledge and create competences, but it contributes to the development of the human's cognitive structures and tools of knowledge needed in the dynamic world.

Let's define the patterns of cognitive approach, determining vectors of its development in modern conditions.

The first pattern: a human-forming component, providing development of the multi-faceted person, possessing social-conformity, nature-conformity, culture-conformity that creates an internal integral unity of higher education system.

The second pattern: the system of higher education shapes the isolated system of public benefit production, in accordance with which multiple cycles are performed: cycles of professional and personal development of subjects of education, cycles of management of educational processes and pedagogical situations, cycles of development of the educational organizations and their structures, paradigm cycles of the higher education system.

The third pattern: process in the higher education, which is defined by purposeful social and pedagogical interaction of actors of education at all levels pedagogical situations, educational process, educational structures and organizations, in the system of higher education, in general.

The fourth pattern: humanistic orientation of social and pedagogical interaction of actors of education acts as dominant professional and personal regulative for enhancing cultural and intellectual levels of subjects of education in the digitalization era.

The fifth pattern: adaptability of the educational organization of higher education in the era of digitalization implies focus of pedagogical situations and educational processes on transformation of didactic time, formation mechanisms of knowledge generation and development of intellectual independence at the subjects of education.

The sixth pattern: management of the educational organization of higher education development provides sustainability of its functioning with a support on active collective strategies, the central place of which is given to resolution of pedagogical situations.

We defined two complementary strategies for the solution of the set problems:

- *social-cognitive approach* - theoretical-methodological strategy determining and developing semantic formation and value transformations of the personality for the purpose of formation of its human-forming and social qualities in the course of socio-cultural interaction of higher education actors;

- *information-cognitive approach* - theoretical-methodological strategy, aimed at lowering uncertainty of the information field of the management object via means of the analysis of necessary and sufficient information, as well as cognitive mechanisms of knowledge generation, capable to reveal its essential “heart” for development of appropriate managing influence.

In the era of digitalization, a completely new organization of pedagogical process and creation of conditions for the development of personal cognitive mechanisms are needed, providing formation of universal students’ human-forming and social qualities, the integral unity of which will determine the solution of professional tasks. Exactly human-forming type of education is the global innovative reserve, capable to change essentially a situation in the modern educational organization in the direction of its humanization. We consider *social-cognitive approach* in terms of process transformation of professional socialization and inter-personal interaction in the context of development of value and semantic formations of the personality.

One of basic positions of this approach is that a personality masters meanings in realities of the subjective world, culture and speech via means of social interaction defining an initial context of teaching at the university as determination of value and semantic transformations of the personality in the course of formation of his (her) human-forming qualities and professional characteristics. Essentially important in the context of realization of social-cognitive approach is being human’s study and development in variety of its cultural and semantic relationship with quickly transformed “digital” reality.

Social-cognitive approach is aimed at mastering human’s culture-conforming, nature-conforming and professional meanings within higher education, transformation to his (her) own concepts on the basis of personal ability to process new information and generate knowledge, along with develop an individual sphere of concepts. Effective development of the following human’s ability determines his (her) cognitive features – mechanisms of cognition defining acquiring of scientific knowledge in the cultural and value dialogue of time, conceptual points of view, which shape an image of an individual and professional worldview. The use of human-forming individual reserves and self-organization mechanisms in educational activities contributes to the development of personal and professional concepts and values that set the direction of meaning, basic and instrumental norms of life in the context of cultural representation.

The prospects of application of social-cognitive approach can be revealed in the opportunity to study impact of social interaction not only on cognitive processes, but on semantic formation of the personality, determining his (her) social behavior and professional positioning.

On the other hand, digital reality caused global information flows, which regulation is the simplified essence of educational processes and educational organizations management. Information serves as an initial point of management – the multidirectional information flows causing the operating influences and a response of education (systems, educational organizations, structures, processes and pedagogical situations). The integral unity of all types of information (organizational, administrative, educational, psychological and pedagogical) should not only be organized in a certain way, but also processed, satisfying the current requirements of higher education practice in the conditions of high “turbulence” of its external and internal environment and the variety of changes within a modern human and functions of the university.

Information-cognitive approach is aimed at the increase in adequacy, accuracy and a range of ideas about management object due to continuous obtaining new knowledge and activity regularities within pedagogical, didactic, organizational, and system interaction of actors of higher education for appropriate management decision-making. Its *advantage* is the significant enlargement of opportunities for managerial practice on the basis of identification of new ideas of functioning of the higher education (pedagogical situations, educational process, educational structures and organizations). Information and cognitive approach “acts” not only on a stage of “knowledge production”, but also at stages of analysis, grouping and generalization, allowing to perform transition from information to knowledge in the sake of their systematization, assessment of the possible reasons of events, creation of possible alternatives of actions for actors of education. It allows to reduce entropy of the higher education (pedagogical situations, educational process, educational structures and organizations) for appropriate management decision-making, including organizational and pedagogical decisions, taking into consideration revealed condition and potential of development, to carry out the managerial influence and to provide control of its result with assessment of the achieved quality of education.

The core of copyright interpretations of the cognitive approach is the following principles:

- human-conformity*, reflecting a focus on a human (his opportunities, abilities, requirements and life mission), in the process of its design and implementation in the system of higher education;
- chronotope*, setting spatial-temporal coordinates of higher education realization in reflection of current and predicted sociocultural development;

-*fractality*, allowing to scale pedagogical situations, educational processes, structures and organizations to the perception of the state of the higher education system without simplifying the parameters of organizational and pedagogical interaction;

-*iteration*, emphasizing continuous development of subjects of education and pedagogical objects in the process of implementation in the system of higher education.

Details of these principles in the main areas of higher education are given in Table 1.

Table 1. Implementation of the cognitive approach principles in higher education practice

Principle	Direction of realization		
	Human's cognitive development	Cognitive didactics	Higher education management
Human-conformity principle	It defines functioning regulative of educational process as its cultural and semantic kernel for personal sphere of concepts, that presupposes accentuation on semantic formation and value transformation of the personality	It causes identification and realization of opportunities for the use of internal informative tools of the person in the attitude towards himself and the subject professional sphere.	It defines the consideration of interests of actors of the higher education in the processes of goal-setting and design of education content
Chronotope principle	It reflects the current and expected socio-cultural personal development concerning the set existing socio-cultural dominant in higher education	It mirrors objective integral unity of subjects of education as a result of their interaction with the educational environment, taking into consideration features of space-time characteristics and continuity of various stages and types of teaching.	It defines edges of management cycles in higher education (educational organizations, structures, processes and pedagogical situations) and their effectiveness in compliance with objectives and the purpose of management.

Fractality principle	It allows to treat human as fractal structure in the system of knowledge, searching for self-organization and development within the hierarchical structural organization of educational and informative process of the higher education in the context of inter-personal interaction in higher education institution environment.	It discovers an infinite set of the self-like relations in the higher education system based on transfer of teaching mechanism, the smallest unit of which is organizational and pedagogical interaction "student – teacher – educational environment".
Iteration principle	It defines the sequence of preliminary, intermediate and final cycles of creation personal and professional perspectives of a human suggesting a real assistance in the choice of person-centered focus on course of life: an active iteration of humanistic values and formulation of pro-social purposes.	It assumes step-by-step achievement of the educational process goals with the control of accuracy of the approach for the allocated cycle of management, and if necessary – correction of activity before achievement of the planned result.

Discussions

In pedagogical scientific research, the cognitive approach is considered mainly with a focus on students' study and development of informative tools (Namakanov, 2011; Bolbakov, 2014). So, Plotinskiy (1998) believes that "cognitive approach is understood as a solution of problems, while using typical methods for this science, by means of consideration cognitive aspects, which include processes of perception, way of thinking, cognition, explanation and understanding" (p. 50) i.e. he puts emphasis on improvement of cognitive methods in pedagogy.

Sergeev (2012) views an essential difference of cognitive pedagogy in the following: “cognitive pedagogy differs from classical instrumental pedagogy, while cognitive pedagogy implies special attention, paid to human’s cognitive structures and tools, and ways of his (her) development, unlike the behavioral focus, peculiar to traditional schools, according to which characteristics of the personality and productive aspect of activity of the person are being estimated” (p.70).

Mozharov (1999) considers that the term “cognition”, illustrating “system manifestations of conscious manipulations with conceptual structures of various subject areas” is the cornerstone of cognitive approach appearance, allowing “to form the pedagogical theory on the basis of basic categories of human’s study: consciousness, thinking, cognition, understanding, etc.” (Available at: https://old.altspu.ru/Journal/pedagog/pedagog_7/a11.html).

The authors of the monograph “Cognitive pedagogy: technologies of e-learning in teacher’s professional development” (Sergeev, Bershadsky, Chorosova et al., 2016) stress on the fact that “cognitive pedagogy accumulates multidisciplinary knowledge from epistemology, cognitive and a neuropsychology, linguistics, neurobiology, and computer science, that allows to solve a number of problems of classical pedagogy”, proposing the solution of this problem. They consider that the use of interface as an element providing inter-connection between participants of pedagogical process “provides formation and change in the given direction of student’s significant cognitive interconnection in the course of dynamic information exchange, passing to the zone of designing mental activity only those changes that are useful and effective for pedagogical and personal plans” (p. 6).

Andryukhina, Lomovtseva and Sadovnikov (2020), exploring concepts of digital didactics, offer to use cognitive aspect as indicators of estimation of information, obtained in the course of teaching, which “characterizes how the person estimates and creates information, critically approaches to work with it, with the computer, media, how he communicates with other users” (p. 33).

Our proposed definition of cognitive approach as the theoretical-methodological strategy focused on the solution of problems of processing, reconfiguration of information and generation of knowledge, taking into consideration cognitive opportunities of the person (perception, representation, knowledge, understanding, explanation) is considered to be an accumulative definition, integrating above-mentioned views of scientists on definition of cognitive approach in the modern pedagogy. Features of author's scientific position are revealed due to cover main directions of higher education: human’s development, development of pedagogical and education systems (cognitive didactics and cognitive management).

Conclusion

In the era of digitalization, a new methodology is needed that can transfer cultural meanings and the system of sciences between generations.

Digitalization has determined fundamental differences between cognitive processes (perception and processing of information), between educators and learners (teachers and students), having generated the different systems of coordinates.

In order to find out of inter-connection of cognition with stages of education and development of the society, appeared new direction in education – “cognitive pedagogy”, transforming processes of teaching and upbringing in the context of formation of cognitive and personal structures of the person.

The following approaches: cognitive, information-cognitive, social-cognitive and principles: human-conforming, chronotope, fractality, iteration act as a new methodology for cognitive pedagogy.

It can be stated that the cognitive paradigm of education, is based on the appeal to ways, types and technologies of human’s processing of information for the sake of creation of a system of knowledge, representations, and competences in a specific subject area and his (her) own system of cognition worldview.

This research can’t claim to fully address the complex and multifaceted problem posed by the development of cognitive pedagogy in the conditions of digitalization. For further scientific research on problem of cognitive modeling of conceptual, term, procedural, structural and content characteristics of educational activity, as well as educational processes and pedagogical situations, operating of visual and logical perception means, convenient for visual and logical appreciation, elements of knowledge and their transformations are of significant importance. The question remains of “convergence” of modern student’s system of cognition and the traditional system of information transmission and formation of competences within the framework of the educational process.

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