Designing the University's Creative Environment: Structural-Functional Analysis

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Designing the University's Creative Environment: Structural-Functional Analysis

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Abstract. Modern educational environments are a technologically challenging phenomenon that can make problematic both proper knowledge acquirement and creative activities of a cognizer. The latter plays an increasingly important role in training of specialists for the knowledge society. Among complicated theoretical issues, the study of which will shed light on the problem of constructing learning environments that combine a technologically sophisticated content and a highly efficient creative function, are the following: (1) separation of "knowledge" and "information" concepts in educational activities; (2) combination of cognitive processes and surroundings in the "creative space" concept; (3) design of a creative space structural-functional model with account of first two items. The article presents a methodological approach to separation of "knowledge" and "information" concepts and, based on this approach, the conceptualization of the "creative space" concept in the form of a cognitively generative system. Fundamentals of the structural-functional analysis for a modern university's creative space, which define the method of its design method are presented.

Keywords: Education · Environment · Creativity · Technology
Knowledge

1 Introduction

The development of a modern university takes place in conditions of knowledge society formation. Supporting socio-economic structures of the knowledge society began to form in the immediate post-war years; among them were a new system of labor division coming with the knowledge worker, as far back as 1957 Drucker fixed an innovative system containing the science; a pluralistic society of organizations; a society, which evolution is based on education [1]. The knowledge society, being a part of the society, is striving for using the scientific thinking as a primary force of production and development of the society as a whole [2]. A new economy, called creative is coming into being, where creativity is the main driver of innovation, entrepreneurship, social, and economic growth [3]. The numerical strength of producing power in the knowledge society called as a "creative class" is growing [4]. Science is increasingly transforming into a single source of additional knowledge, and knowledge positions itself as a new axial principle of the society [5].

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The creation of new knowledge, their technological transformation and inclusion in the socio-economic circulation are gaining an increase on a scale and a decisive importance for modernization of the society and a growth in prosperity of citizens. Scientific-type creative thinking is the fundamental basis for this activity, and the university is its center [6]. The university develops creative abilities and imagination of a knowledge worker, which form the basis for scientific innovative and entrepreneurial competencies [7].

The modern university absorbs the latest technologies, which become the instrumental basis for development of cognitively active environments formed by new learning methods, e.g. blended learning, problem-based learning, personalizing learning, deeper learning [8]. For example, among its objectives, the MIT Innovation Initiative (2013) points to the creation of "an ecosystem where student ideas become world-changing technologies" [9]. Such an ecosystem should include extended-type innovation-oriented spaces. They are a place for learning, combining knowledge with practical activities for solution the problems facing the society. They promote cooperation between students, professionals, scientists, teachers and form effective teams that create startups [10]. The report by MakeSchools Alliance founded by 40 American colleges and universities informs about implementation of the Makerspaces concept integrating different tools and disciplines and may combine an art studio, a machine shop, a computer lab, a bio lab, etc. Their technological infrastructure is used as a place of "blending practical learning and creativity", where deep experience of interdisciplinary collaboration and maker culture emerge, "can-do" thinking is developed, and abilities to take creative risks and tackle difficult tasks are generated [11]. By implementing methods of research training the Russian "Step into the Future" scientific and social program creates local creative spaces on the basis of universities making possible to study the world by "adult" methods; among them are youth scientific laboratories, design bureaus, tree farms and agro-enterprises [12].

Cognitively active environments are often interpreted as creative spaces with electronic content as a mandatory component.

Indeed, at the University of Strathclyde in Scotland, the creative space of the educational cluster "includes an interactive classroom, seminar rooms and teaching studio <didactic and technological training center>, providing a mix of peer instruction, problem-based learning and studio teaching" [13]. The American Trinity University in San Antonio defines its creative spaces as a set of specialized rooms and a common hall equipped with high-quality information and professional engineering resources [14]. At the University of Essex in the UK, this type of premises, which is defined as a creative space, is an innovative laboratory (iLAB). It is used for meetings encouraging creative thinking and problem solving [15]. The system of creative spaces at the Granoff-Center of the Brown University (USA) is described as a set of technically-rich rooms decorated by designers, which include lecture rooms, production and design studios, galleries, laboratories, sitting-rooms [16].

The modern university develops *an academic* form of digital literacy, which allows a person to become a true participant in creative spaces and is one of the basic competencies of the knowledge society [17]. Digital literacy is not only a capacity for mechanical transformation of information, but, to a much greater extent, a special sphere of thinking that functions in the cybernetic world. Indeed, the OECD report

emphasizes that the solution to problems in technology-rich environments is found as a result of combination of digital and cognitive skills [18]. The ICT literacy model for higher education proposed by J. Perez and M.C. Murray, makes computer user's generativity a cornerstone, i.e. the ability to acquire new skills and generate new knowledge which form the basis for innovations and creativity [19].

Thus, the fundamental foundation of the modern university is a complexly organized creative learning environment, where theoretical models allow us to shape an epistemic image of modern education. At the same time, experts direct attention to a discrepancy between intellectual needs of students and educational environment [20]; an educational problematic character of "smart" classes, when they are transformed into an intricate bundle of technical gadgets [21]; cognitive losses causes by new technologies [22]; lack of studies in the field of theoretical understanding of creativity in education [23]. The latter is especially important, because the creative training has specific educational risks, including unpredictable and uncontrollable training outcomes, as well as poor management of the knowledge acquisition process [24].

Among complicated theoretical issues, the study of which will shed light on the problem of constructing learning environments that combine a technologically sophisticated content and a highly efficient creative function, are the following: (1) separation of "knowledge" and "information" concepts in educational activities; (2) combination of cognitive processes and surroundings in the "creative space" concept; (3) design of a creative space structural- functional model with account of first two items.

By this article the author makes his contribution to the solution of these challenging problems. For better understanding of the below stated, it is useful to bear in mind the prerequisites that have an effect on the completed study.

One of these prerequisites is the desire to overcome the information-translational view of education, which is based on the illusion of the exclusively sign nature of education. Indeed, very often we are dealing with pedagogical views and practices that proceed from the fact that the act of teaching will be undoubtedly actualized when a pedagogical subject represented by educators (a person, an artificial brain or an interactive computer program) will produce a certain amount of "educative" information, supported by control measures. In other words, it is believed that specific sign systems (text, audio, visual) are quite sufficient for knowledge "transfer". The developed by me methodological approach to separation of "knowledge" and "information" concepts shows that this is not so; i.e. educational-type sign communication, for example, in audio or electronic forms, is not the knowledge-based training.

Proceeding from this statement, I ask the question: "What can transform information "training" into knowledge-based training? One of the answers is the creative space representing a cognitively generative system. Its fundamental principle of functioning is the separation of "knowledge" and "information" both at the conceptual level and at the level of cognitive processes taking place in reality. Not to be bare words, I will define the theoretical content of the "generativity" concept, highlight the most promising approach to understanding and designing the creative space, and then, using this approach, I will present my own concept of the creative space and the method of its designing at the level of structural-functional analysis.

2 Methodological Approach to Separation of "Knowledge" and "Information" Concepts

The "knowledge" concept plays a key role in solution of modern education problems. In particular, this is true for those areas of educational activities, where sign types isolated from a teacher and a learner, e.g. e-learning, are dominating. Therefore, isolation of the "knowledge" concept from other phenomena expressed through a sign, and first of all, from the "information" concept is a necessary condition for authenticity of research, design and implementation of educational activities. This is not an easy task, but it requires its solution. Attempts to identify differences at the level of structure, systematicity or abstraction of the content, as often done, are unlikely be successful, since there is no information without structure most of it is systematically organized, and today, such an absolutely informational object as a media message can carry in itself an arbitrarily large volume of abstract content. The most well-known features the knowledge (but not information) possesses is an active character of knowledge and its ability to generate new knowledge. However, our task is to clarify this issue at a deeper level – in direct association with a learner's personality.

A contradictory set of viewpoints that correlate knowledge with information can be found in a specialized discourse.

The concepts "knowledge" and "information" are often used as interchangeable, i.e. it is assumed that their meanings are the same [25, 26]. So, Toffler does this "to avoid tedious repetition" [27]. Sometimes the identity of these concepts is hidden behind special formulations. For example, Farradane defines information "as a written or spoken surrogate of knowledge" [28]. Uriarte argues that knowledge is processed information, where location for tacit knowledge is human brain, and for explicit knowledge – documents and other media other than human brain [29]. Nonaka and Takeuchi reduce the creation of new knowledge "to the conversion of tacit knowledge to explicit knowledge" [30].

Knowledge is deemed as a part of information. So, Porat takes knowledge as a specific type of information [31]. Knowledge is identified "as the highest order manifestation of information" [32], as the highest form of information [33]. At the same time, there is a certain consensus that knowledge is more than just data or information [34].

A number of experts include information in the categorical field of knowledge. Machlup believes that "all information in the ordinary sense of the word is knowledge, though not all knowledge may be called information" [35]. The UNESCO report "Towards Knowledge Societies" states that "information remains a fixed stabilized form of knowledge" [36]. Kogut and Zander distinguish two categories of knowledge – information and know-how; the first is "knowing *what* something means", the second is "knowing *how* to do something", i.e. similar to declarative and procedural knowledge in the theory of artificial intelligence [37]. Davenport and Prusak view knowledge as a fluid mix, where one component is contextual information [38]. Horibe treats knowledge as "a body of information, technique, and experience that coalesces around a particular subject" [39].

Due to transfer the technical understanding of information to the socio-humanitarian field, it is interpreted as a heterogeneous set of sign systems. Technical

transformation of messages is not dependent on their content; therefore, the applied theory treats information as an abstract set of signals and signs. Similar approach is not uncommon in information society theories, which meanwhile try to clarify the *content* of cultural, social, economic meaning of information. In these theories, everything that is expressed in a sign is treated as information. Meanwhile, roles of various sign systems in life of a man and his collectives can be *substantially* different.

Meaning of a concept must be productive for the field of its use, i.e. have a resolving power and analytical capabilities regarding problems that the theory faces. A concept should have power for contrastive separation the problem from a contextual background, definition of significant features, and arriving at a solution. Following Berger and Luckmann, Hornidge in his study of knowledge society defines knowledge "as everything that is regarded as knowledge in and by society" [40]; thereby he substitutes the subject of research for a very heterogeneous (in the semantic sense) discourse, which gives the term "knowledge" a diverse and contradictory meaning (examples were shown above). Definition of knowledge through a sign causes difficulties in analyzing knowledge as a producing power of modern society, because a sign taken as it is can produce nothing.

My methodological standpoint is the following: knowledge is not information and cannot be derived in its own definition from it, and information is not knowledge and it can't become it by itself (although information can *take part* in creation of knowledge). Knowledge and information are not specific kind to one another. Knowledge and information are *expressed* in a sign, but this does not mean that they are a sign and much less they are the one and the same. The common form does not at all indicate the identity of the embodied.

In the words of F. de Saussure [41], a sign as a combination of meaning and image, which in equal measure are psychic, is used for expression of something; including something created by thinking. Novels, political acts, technical designs, recommendations to women of fashion find their expression in the form of a sign. However, they also exist external to the sign. Information speaks about them, knowledge gives them existence. But this does not mean that they are knowledge or information. All the wealth of symbolic objects is cannot be reduced to such categories as "knowledge" and "information".

Information is an expression of impact of external in relation to psychic of an individual on internal – psychic. Information is included in perception of the impact so that it *witness* about it. Knowledge, both explicit and tacit, grows from the psychically internal and as psychically internal. This internal is also knowledge, but for the most part is thinking growing both itself and knowledge. Knowledge is an expression of the impact of the internal or psychic of an individual on the external in relation to this psychic. Knowledge is included in shaping this impact in such a way that it lies at the base of it and defines it. At the same time, the existence of knowledge and information implies each other. Information triggers the process of knowledge growth, and knowledge lies at the heart of information perception.

The expression "work with knowledge" and its derivatives has a double-meaning: as an effect of thinking on one's own knowledge or on external forms of knowledge locution – its mediators, which are objects of psychic or non-psychic types (the latter includes, e.g. designs, mechanisms, technology, scientific publications, technical

documentation, databases, patents – all that is included in the category "knowledge-intensive" objects that are material representations of knowledge). A knowledge worker is first of all characterized by work of thinking with external "bearers" of knowledge.

3 Creative Space as a Cognitive-Generative System

Now it's time to ask the question: "What is it in reality that organizes and provides processes of knowledge growth in a learner – a talking "chair", a flickering computer screen or something more behind it that includes contextually complex forms of knowledge "transfer" and stimulates their internal growth?". My answer to this question rests on the idea of generativity. It characterizes a generating principle that actively stimulates cognitive thinking towards creative-type productive activity, including the creation of knowledge, its materialization in things and technologies, and use in solving problems of the society. Generativity is an epistemo-didactic parameter for both the environment and learning.

In present-day research-type education, a mutually conditioned system of "environment-method" relations is in operation. Components of this environment embody socio-morphic models of research thinking; among them are a laboratory, a scientific expedition, a discussion club, a startup, etc. They are not only enablers for implementation of one or another research-type training method, but they by themselves are instruments of cognition. In turn, the method imposes requirements on the content and functional properties of the training environment; it creates and modifies forms of the research cogito implementation in the environment.

Generative learning empowers a person with an ability to produce objectively new knowledge, to create mental, physical and social ways of knowledge transformation, to convert knowledge into a material product [42]. Of course, the generative learning can be treated as specialized creative training; but I believe that it is considerably broader in its content. In addition to processes of creativity and ways leading to it, the research-type generative learning in its content includes formation of scientific-type research behavior and problem-cognitive programs of cognitive growth of personality [43]. It possesses a significant axiotic component that includes creation of a value system of personality – specific to epistemic communities. Components of this value system are perfectionistic attitudes to truth and its search; a priority of thinking, cognition, and self-realization among life orientations; scientific ethics of partnership and competition; imperative of cognitive freedom, etc. The instrumental part of the research-type generative training contains such uncreative components as collection and processing of experimental data; maintenance, adjustment of scientific equipment and subsequent working at it; study of research methods and scientific communications.

The generative learning environment is an emergent compound of cognitively active forms of cognitive activity, organizing and structuring this activity of sociomorphic open-type structures, as well as a special cognitive functionality included in training practices.

The generative learning environment contains uncertainties stimulating the imagination; they are contained in those problems that are solved or can be set in it.

Problematic situations it offers give materials for a choice of a cognition subject and its comprehension, thereby structurizing the cognitive activity. In scientific techniques and forms of scientific cognition organization it is saturated with, instrumental knowledge directing research activities and leading to discoveries is codified. Collectives of people engaged in professional working with knowledge, demonstrate patterns of search activity. Along with the fact that this environment is a "driver" in academic cognition, researches, and developments (both training and professional), it contains authoritative truths and rigorous epistemic models to be overcome when searching for new knowledge. In such a way, the generative environment "teaches" to achieve scientific truth.

The generative learning environment operates as a system of cognitive heuristics, i.e. presumably defines the best or optimal methods of cognitive activity in specialized problematic contexts, relying on a complex of dominant epistemic logics. At the same time, here is the place for ideas testing and creative productivity. Using this environment, the school and university goes beyond the boundaries of the pure learning space. It leads to the emergence of principally new properties of the learning process, such as its indeterminacy, openness and transformativeness (self-modification), auto-regulation of cognition, and dynamism of cognitive contexts.

In general, the generative learning environment is defined by me as an educational system that encourages and builds a creative thinking function and possesses required socially active cognitive components. Let's focus this definition on the educational environment of a university involved into production and transformation of new knowledge. This generative environment represents an institutionally distributed and cognitively active educational system, which (1) didactically shapes and epistemically directs learning towards formation of a knowledge worker, (2) has a dynamic set of cognitive structures capable for individual tuning and stimulating scientific and sociocognitive development of personality.

This very general theoretical construct specifies a framework description that can be concretized by models revealing its contents from perspectives of one or another problem solving.

Analysis of the generative environment as a structurally complicated epistemic *surrounding* leads to cognitive-constructive concepts. For example, the "learning and scientific innovation environment" construct developed by me for Russian universities can be interpreted as an epistemic mega-constructor containing socio-morphic extracurricular-type structures performing specialized work with research cognition and its products. Its components are quite diversified. Among them are research teams, business incubators, small innovative companies, student scientific societies, technology consortia, generalized knowledge funds, etc., which are distributed and classified at a structural-functional level and a meta-level.

The analysis of generative environment as *a creative* basis for development of the personality possessing an active cognitive functionality, led me to its definition and theoretical description in the form of a creative space.

The creative space is defined by me as a cognitive-generative system that stimulates creative activity and ensures cultivation of a creative function of thinking by creation of collective and individual forms of synthesis of cognitive practices with the epistemo-active environment.

Generative creative spaces at the University 1.0 should stimulate knowledge and have a socially-enriched constitution. At University 2.0, their area of responsibility expands into spheres of creation of scientific, social and technological innovations; in addition to above-listed at the University 3.0, - into the field of socio-economic activity. The university's generative system should act as a holistic epistemo-didactic complex, which makes the University a direct social actor in creation of the knowledge society.

4 Types of Ideas About the Creative Space

In scientific sources and information resources, there is a very heterogeneous set of ideas about the content of the "creative space" concept. After analysis and selection of similar approaches, I divided them into three basic types. The first type of ideas defines the creative space as an environment that surrounds learning or creative activity; the second type focuses on cognitive processes; the third type combines these viewpoints into a complex approach and considers the creative space as a process-environment cognitive system. In accordance with these approaches, conceptualizations and models of the creative space are built.

A complex type of creative space conceptualizations is at an early stage of its development. In terms of a depth of comprehension of the social and epistemological problems of the present-day education, it is the most promising. This is due to the fact that education efficiency and creative productivity are, by no means, guaranteed by the design, physical and technological content of the surrounding space, although the latter may be able (as well as unable) to give them a certain contextual support. However, each *specific* creative and pedagogical situation requires definition of that context, which *in reality* is able to exert a positive effect on creative activity and learning. My approach develops a process-environment type of conceptualizations.

Let's denote key points and give examples that characterize three types of creative space conceptualizations.

The most widely-spread is the first type of conceptualizations that represents the creative space as a model of surrounding. The reason for this is its utilitarian nature, superficiality containing a variety of feelings and opinions (including those conflicting), low exactingness to special knowledge, leading to public accessibility. Design and interior of educational buildings and class rooms, artistic studios, business offices, scientific and industrial infrastructure, etc. are presented here as a creative space [44]. Academic developers take part in designing as advisers and generators of ideas; for example, "to create a colorful, playful, casual environment" in working areas of a university library [45]. The meaning of the creative space here is in essence ergonomics and technical equipment of the premises that, in my opinion, has little in common with "creativity". The main question by this approach is universality of solutions, i.e. their authenticity not only for different cognitive, social, and cultural types of a knower, but also for different pedagogical subject. Commercial interests of thirds parties – architecture companies, design studios, gadgets manufacturers, and large corporations – play a prominent role in distribution of this approach.

The second type of conceptualization is characterized by theoretical representations of the creative space in the forms of ecosystem and socio-epistemological models of

cognitive processes. An example of the first model is the experimental business laboratory described by M. Curley and P. Formica as a process creative space that performs research of innovative operations and development of start-ups in university ecosystems [46]. An example of the second model is the model proposed by A. P. Wierzbicki and Y. Nakamori that describes the process of knowledge increment using the expansion of SECI Spiral concept by Nonaka and Takeuchi. The term "creative space" in this model denotes a formal scheme for transformation of knowledge in the transition between nine nodes that represent combinations of social attributes and cognitive properties of thinking [47].

The third type of conceptualizations is based on the creative space representation in the form of a cognitive system, where working with knowledge and the environment are integrated into a single whole. Both have a generative nature. Moreover, working with knowledge includes processes of knowledge acquisition, creation, social "revival" and associated processes, and the environment incorporates essential components of society, economy and culture. Let's us study the following example in details, because it shows a tendency to a comprehensive solution to the problem of "environment-way of knowledge" in the creative space, at least at a declarative level.

A cognitive-adaptive approach to functioning of creative space as an environment model is implemented in the Creative Center at the University of Brighton located in England. The Center was an integral part of the "InQbate" project which set the goal to found the Centre for Excellence in Teaching and Learning, CETL in the field of creativity. The idea was to make cognition-flexible and technology-rich creative spaces for modernization of teaching and learning environment. It was in line with the UK Government's policy, which "saw the development of the 'knowledge economy' through education, technology and creativity as a way of developing and sustaining the country's economic wellbeing in the face of turbulent global market forces" [48].

From the physical standpoint, the Creative Center represents transformable classroom spaces (open planning) and technological furnishings. Its decoration is neutral because architectural innovations may be educationally problematic. Technological part is composed of virtual, mobile, and Web 2.0 developments, multimedia audio- and video technologies, accessories, including 3D-mouses, video cameras, visualizers, and electronic boards. The flexible learning space in the Creative Center is designed for seminars, training courses, conferences, exhibitions, Doors Open Days at the University [49].

The creative space in the Creative Center is thought of as something greater than its physical part. It is represented by an assemblage of such spaces as a *physical space* (arrangement of training places), a *virtual space* (electronic networks), a *psychological space (*character, values, beliefs, emotions), a *biological space* (mental and physical abilities), and an *interpersonal space* (communications, social interaction) [44]. Development of specific implementations of the creative space is based "on … own researched needs relevant to issues of pedagogy, context, disciplines and institutional culture" [49].

J. Boyce is an adherent of the third type of creative space conceptualizations. He views the creative space as a way to improve higher education. He believes it necessary to develop a theory and methods to study the link between social-epistemological and spatio-contextual processes in creative spaces. His "book aims to look beyond …

'beanbag' approach to learning space design". This cursory approach (the first type of conceptualizations) means in the context only "playful settings, bright colors, natural lighting and softer furnishings" that saturate "learning cafés, informal seating areas, corridor alcoves or social 'hubs' ". Boyce considers the creative space as "one of our means of thinking about the world and embodying thought into action". Rethinking the links between space and learning is invited to conduct based on examining the intersections between three main factors: (1) social and spatial practices of epistemic communities; (2) designed learning environments; (3) "participant perception of space, and their engagements with, and adaptations of, both learning spaces and practices" [50].

5 Structural-Functional Analysis of the University Creative Spaces

The system of creative spaces providing and guiding scientific and socio-cognitive personal growth is a fundamental component of the cognitive space at a contemporary university.

Creative spaces for various university models should be designed from the perspective of education a person in line with university's dominant missions, rather than simply students, future engineers and professionals. For University 1.0, it is academic training of professionals (single-discipline or multi-skilled specialists) possessing the propensity for creativity within the acquired disciplinary knowledge system. For University 2.0 (research-type university), the creative spaces are focused on research training of future scientists and engineers-researchers, i.e. they are addressed through the lens of training young people capable to create new knowledge, techniques, and technologies. For University 3.0, in addition to the above-listed, the creative spaces should be oriented towards education of professionals possessing scientific-entrepreneurial creativity.

The university creative space is a place of psychosocial and professional growth for very heterogeneous knowers. In addition to undergraduate and graduate students and postgrads, the University provides its own cognitive resources to in-house or outsourced teachers, scientists, professionals as well as students of other educational institutions, including school children. The knower heterogeneity is one of the main reasons for a variety of creative spaces at the modern university. Another reason is originality of environmental factors influencing on the cognizing personality creativity. Consequently, the generalized personality of a knower requests from the modern university a highly enriched system of creative spaces.

This system of creative spaces represents an interrelated and interacting set of cognitive-generative systems institutionalized in the structure of an educational institution. Its richness determines the emergence of directing effects on creative thinking. A separate cognitive-generative system is a local creative space with its organization and dominant function (mission).

Thus, local creative spaces at the university possess a *scientific-educational mission* and their bearers are a department and faculty, a scientific group and a research laboratory, various communication activities such as conferences, colloquiums, scientific schools. *The entrepreneurial and innovative function* is assigned to start-up companies,

technology transfer centers, business incubators, technology consortiums, technoparks, etc. *Special* functions in the University's creative system are performed by scientific student societies, Internet resources, partnership networks, libraries, affinity groups, community centers, museums, hostels.

Any local creative space is characterized by its unique set of components having an effect on creativity. They include cognitive roles, epistemic processes, research and cognitive instruments, physical space, "mental atmosphere", values, attitudes, traditions.

Theoretically, the creative space is described as an *ideal type*, i.e. not as a *specific* sub-faculty, laboratory, research group, library, etc.; but as their collective image concentrating and representing maximal generative potential (in terms of knowledge, personal development, available opportunities). Definition and qualitative description of the *system* of local creative spaces as ideal types make it possible to construct a creative university model in a most enriched and productive version with due account of possible interlinks and interactions. Comparison of this model with the reality of one or another university reveals opportunities for its modernization.

For the creative space taken as an ideal type, it is necessary to find a complete set of key factors influencing on creative activity of a knower for the creative space taken as an ideal type. These factors can be categorized and grouped into functional complexes identifying the types of creative space activity. For example, the content of the "*scientific and social development of an individual at the university"* complex includes processes of involvement into research-cognitive activity, its management and supervision, ways for engagement in collectives of cognitive personality growth, mechanisms for social positioning in the society, etc. The *epistemic-psychological complex* includes tools to generate the motivation to creative activity, scientific attitude to the truth, scientific-type research behavior, value orientation and attitudes that regulate manifestation of scientific creativity, etc. The *exchange-communicative complex* contains ideas and knowledge transmission processes, their mediators and configurations, including network and institutional interactions. And so on.

The University's common creative space can be described in the form of "horizontal", "vertical" and "horizontal-vertical" schemes. The "horizontal" scheme is a set of creative spaces superimposed on one another (like sheets of paper in a common pack). In the creative activity of the university, there are various "vertical" links between "horizontally arranged" creative spaces. Method for construction the order in these complicated relations is merging of *homonymous* functional complexes of different creative spaces into a structurally functional system.

Interactions between *homonymous* key factors influencing on creative activity of knowers and belonging to different creative spaces should be studied within each of these "vertical" systems. Let's take, for example, processes of involvement into research-cognitive activities as this homonymous set of factors. Analysis of their interaction between creative spaces of a sub-faculty, a research laboratory, a business incubator, a library, etc. can find one of "vertical" elements contained in the structure of links between local complexes of scientific and social development of an individual. More complicated vertical-type functional dependences can be derived from the analysis of links between *heteronymous* key factors and their sets (including going beyond one complex), functional complexes alone, and their sets.

A set of structural and functional systems forms a "vertical" scheme of the total university creative space. It includes such structural-functional systems as personality scientific and social development, epistemic-psychological, exchange-communicative, infrastructural-environmental, meta-functional (provides emergent links between intentions, ideas, activity, cognitive cooperation). The totality of links between structural-functional systems can be treated as a "horizontal-vertical" scheme of the university creative space.

The structural-functional analysis of the creative function for a specific university consists in identification the content and internal links in "horizontal", "vertical" and "horizontal-vertical" scheme of its total creative space. The relationships and interactions between university creative spaces identified as a result of the structural-functional analysis give us a description of the epistemological design of institutionalized creativity.

The creative space concept developed by the author gives an approach to the methodology of its structural-functional analysis. It has been approbated in the "Innovative Education at the Technical University" scientific laboratory at the Bauman Moscow State Technical University. The completed research works have shown a high potential of the developed theory in studies of the University's creative function.

6 Conclusions

The creative function of a modern university is the key driving force in the knowledge society development. The ability of the university to fulfill this mission is determined by the level and capabilities of its creative system which is based on a structurally and functionally complex system of creative spaces. The theory of creative spaces plays a key role in creation of training systems resting on technologically saturated environments. Their educational authenticity depends on the ability to support and develop creative-type cognitive processes. One way to achieve this is designing these systems in the form of creative spaces which integrate generative learning methods with a cognitively active educational environment.

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