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**NEUROPEDAGOGY AND BIOETHICS' SYMBOLISM: PLACE IN
KNOWLEDGE MANAGEMENT**

Nina A. Pervushina (a)*

*Corresponding author

(a) Tomsk State Pedagogical University, 634061 Tomsk, Russia

Abstract

The convergence of information, biomedical and cognitive technologies results in growing popularity of neuro-sciences. Neuro-sciences related to humanitarian research (including educational) emerge. The goal of the research described in the work is to define a measure of conceptual novelty in combining neuro-science and pedagogics. To reach the goal stated, the author solved the following tasks: searching for criterion dividing the initiative of naming from the initiative of neuro-science's research; setting the stand from which researching programs of neuro-science were developed; uncovering ethical aspects of neuro-science from a bioethical point of view; defining the relevant position for discovering neuropedagogy' perspectives in knowledge management. As a criterion of neuroscience, the one suggested by A.Y. Alekseev was selected: a science may be reasonably called “neuro” if its methods are mostly connectionist. This criterion emphasizes two moments: specification of neuroscience methods and the interdisciplinary nature of this new branch of science. Neuropedagogy must take into consideration the specifics of neuroethics', neuroesthetics' and neurophilosophy's epistemology. Along with this, “neuro” prefix supposes examined impacts aimed at the brain and corporeality. In its turn, this causes the necessity to take into account the bioethical problematics while implementing such impacts. Popularity of neuro-science in humanitarian research is a symbolic reaction to convergent technologies. This is implemented in bioethics' symbolism within the modern culture and related to knowledge management.

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Keywords: Neuropedagogy, bioethics, perception of symbolism, information-synergetic approach, “semiotic attractor”, knowledge management.



1. Introduction

Efficient management of knowledge is a necessary component of formation and development of the modern human. In this regard, appealing to neuro-sciences and mostly to neuropedagogy is substantial. This discipline is interdisciplinary and involves usage of results obtained within other neurosciences. Since according to the modern research (Macajova, 2013) in the progress of education, the brain changes physically (Chernigovskaya, 2010; Slioussar et al., 2014; Zuk et al., 2014) and the very education is permanent and not always purposeful, it is important what information and which way the human being obtains it. It is a determining factor in understanding hybridization of neuropedagogy and knowledge management. Creation, storage, distribution and usage of necessary knowledge gain a special importance. At the same time, interrelation of cognitive and corporeal impact of information invokes bioethical aspect of the problem. In its turn, recently the symbolism of bioethics influences the relevant competences in education for various specialties (Ardashkin, 2015; Ardashkin et al., 2015).

2. Problem Statement

Convergence of information, biomedical and cognitive technologies (Roco & Bainbridge, 2003) resulted in growing interest in so called neuro-sciences. If twenty years ago these sciences included only neurophysiology, neurobiology and neuropsychology (and only the latter belongs to humanitarian knowledge), today neurophilosophy (Churchland, 1986, 2002; Alekseev et al., 2015; Robbins, 2015; Balaban & Gulyaeva, 2016), neuroethics (Hardiman, 2012; Churchland, 2006; Razin, 2015), neuroesthetics (Shestakova, 2015), neuropedagogy (Posner & Rothbart, 2007; Schlaggar, 2007; Moskvina & Moskvina, 2001; Pervushina & Osetrin, 2017), etc. became legitimate. There is such impression combination of any humanitarian discipline name with “neuro” prefix, which is able to name a new science, and the right to existence of this new science will not be questioned. Such feeling manifests the problem because it is a logic of myth when a name precedes a substance. Abundance of myths following the reality of convergent technologies turns it into the problem. Expansion of these technologies into an educational sphere (which is responsible for “reproduction” of ideals and values inherent in definite socio-cultural systems) defines topicality of the problem research.

3. Research Questions

To solve the stated problem, the following point must be addressed:

- searching for a criterion dividing the initiative of naming from the initiative of neuro-science's research;
- setting the stand from which researching programs of neuro-science were developed;
- uncovering ethical aspects of neuro-science from the bioethical point of view;
- defining the relevant position for discovering neuropedagogy' perspectives in knowledge management.

Solving these tasks allows one to reach the stated goal.

4. Purpose of the Study

The purpose of the given study is to discover a measure of conceptual novelty in hybridization of neuropedagogy and knowledge management.

5. Research Methods

The primary research method is an information-synergetic approach that is closely related to the system approach in Russian tradition (Melik-Gaykazyan, 2010) and resulted in building the models (Melik-Gaykazyan et al., 2016; Rogotneva et al., 2015). The information-synergetic approach was tested in research of interrelation of Hi-Tech system self-organization (Melik-Gaykazyan, 2016), transformation of education systems in the context of self-organization of convergent technologies (Mescheryakova et al., 2016) and non-linear dynamics of socio-cultural systems (Gorbuleva et al., 2016; Tarasenko et al., 2016a) that allowed revealing emergence of bioethics' symbolism and its linking role in transformation of scientific, educational and cultural systems (Melik-Gaykazyan, 2014, 2015; Melik-Gaykazyan, Gorbuleva et al., 2017). The value of the approach lies in the possibility to measure a spectrum of impacts rendered in a process of education (Mescheryakova et al., 2016).

Scaling the problem situation from review of its epistemological structure to uncovering perspectives of neuropedagogy will be the method of reaching the goal stated. The chosen methodological strategy defines the sequence of reasoning, namely, the structure of the work based on four “steps” as jumps to more detailed analysis.

6. Findings

The first step in reaching the goal was searching for a criterion dividing the initiative of naming from the initiative of neuro-science's research programs. This step resulted in discovering the formal criterion suggested by A. Alekseev (Alekseev et al., 2015): a science may be called “neuro” if its methods are mostly connectionist (Alekseev, 2014), but if the brain activity is researched using behaviorist methods and there are theoretical generalizations of interdisciplinary nature, then this is a science about “neuro” not neuro-science. For example, if “the social” may be manifested as neural network specification, this is “ordinary” neuro-science (neurosociology). Hence, the criterion suggested by A. Alekseev is distinguished by 2 points: specification of neuro-science methods and the interdisciplinary nature of a new discipline (Alekseev et al., 2015).

Neuropedagogy is explicitly synthetic because it absorbs neuropsychology, neurophysiology, cognitive neurology, differential psychophysiology, cybernetics and pedagogics (Moskvin & Moskvina, 2001). Listing the components of neuropedagogy (that is, interdisciplinary sciences themselves) would mark the sources of a new discipline. Some basics of neuropedagogy can be found back in the conception of non-classical psychology offered by Lev S. Vygotsky:

- a) separation of “elementary mental functions” (visual-efficient thinking, involuntary attention, emotional memory etc.) and “higher mental functions” (speech, verbal-logical thinking, voluntary attention etc.) (Vygotsky, 1982);

b) a concept of the zone of proximal development, based on the maturing of the brain (Vygotsky, 1982);

c) a school of neuropsychology that became the development of these ideas. At least, that is the way Alexander R. Luria created neuropsychology. He developed the concept of a system structure of higher mental functions, their variability and plasticity, emphasizing the intravital character of their formation and its implementation in different kinds of activity. Thereby he developed a new approach to the problem of location of higher mental functions. In accordance with this approach, “higher mental functions as complex functional systems cannot be located in narrow areas of cerebral cortex or isolated cellular groups, but should embrace the complex systems of jointly operating zones each contributing to implementation of complex mental processes that may be located in absolutely different, sometimes parts of the brain distant from each other” (Luria, 1973, p.74]. This quotation points to the connectionist paradigm of neuropsychology.

Neuropedagogy, in the Russian tradition, should extend the classic neuropsychology of Alexander Luria and include the principles of teaching and educating, a culturological principle of education in their correlation with the processes of brain forming and development of human mentality. The founders of neuropedagogy in Russia are V. Moskvina, N. Moskvina, V. Yermeeva, T. Hrizman (Pervushina & Osetrin, 2017). The up-to-date conception of neuropedagogy is partly based on the theses of neuroscience (Macajova, 2013; Hardiman et al., 2012; Posner & Rothbart, 2007; Schlaggar, 2007; Battro, 2008). But in the most cases, neuropedagogy researches the characteristics of education on the base of interhemispheric asymmetry (the review of related works by Pervushina & Osetrin (2017), or refers to defectology (Vandermeulen & Ansink, 1995; Moskvina & Moskvina, 2001), a neuropedagogy of emotion (Patten, 2011). With a help of Alekseev’s criterion, it is possible to discover the key difficulty why neuropedagogy is not neuroscience fully. That is because of implementation of the latest theoretical generalizations for appropriate specification of pedagogical methods. This difficulty is illustrated, in particular, by criticism of conceptions related to the role of interhemispheric asymmetry of the brain in learning processes based on the recent neurobiological research. According to T. Chernigovskaya, appealing to interhemispheric asymmetry of the brain is justified only when there are serious clinical damages. In other cases, people are poly-functional and the neural networks are working in a complex, dynamic and contradictory way. As for fine arts, it is versatile to be located in the right hemisphere solely (Chernigovskaya, 2010). This point is confirmed by neurosurgeons (Marsh, 2014) who noticed that, when definite centers located in the same hemisphere are damaged, the brain is rebuilt and functions of damaged centers may be handled by another hemisphere.

The second step was to determine the principles by which researching programs of neuroscience were developed. The author would emphasize that the above-mentioned criticism (Chernigovskaya, 2010) was based on achievements of neuro-science for the past decades with a help of another discipline known as artificial intelligence (Alekseev, 2014). Exactly from the positions of the given discipline, A. Alekseev (Alekseev et al., 2015) introduced a formal criterion by which neuro-science distinguishes “its own” field of research from the field of research conducted only “by analogy”. Interrelation between science and artificial intelligence implies that AI systems should be capable of “self-teaching”. Technical imitation of

this process allowed to uncover many mechanisms inherent in natural intelligence. Education changes the brain physically – T. Chernigovskaya remarks (2010). The statement is based on generalization of many research data. It was proven that density and quality of neural network and glias increased as a result of education, dendrites and axons providing the growth and modification of intracerebral connections; even the size of nerve fibers increases (due to intensive myelinization) (Zuk et al., 2014). That is, education is a direct impact on brain tissue (Alekseev et al., 2015; Chernigovskaya, 2010; Slioussar et al., 2014). Wherein the brain is learning not only in the process of purposeful education (for example, in school or university) but in fact there are no situations when the brain is not learning. That is why it's very important which information and which way a human obtain and this is the sphere of pedagogy. But there is a point that is emphasized in the work, specifically coherence of cognitive and corporeal impacts actualize bioethical side of modern education. The given nuance will be observed below. Currently it is important to pay attention to a specific contribution of “artificial intelligence” discipline to the development of neuro-science. The contribution is in switching biomedical research from «in vitro» to «in silico», i.e. development of the technical means allowing to conduct the virtual experiments which resulted in drastic change of ethical regulations (developed initially for experiments «in vivo» (Melik-Gaykazyan & Mescheryakova, 2015; Mescheryakova et al., 2016)) applied to such experiments. In the context of convergent technologies elaborations «in silico» on some “artificial human” can be applied to quite real humans.

The third step was to discover ethical sides of neuro-science from bioethical point of view. The point is bioethics protect individuality of human (Meshcheryakova, 2011; Mescheryakova & Melik-Gaykazyan, 2015) in medicine area but not at training and education areas currently. Though it make sense to apply the rules and principles developed by Tom L. Beauchamp and James Childress (Nonmaleficence, Beneficence, Autonomy, Justice and rules of truthfulness, confidentiality and informed consent) at education field (Mescheryakova et al., 2016). Thus, for example, a trainee and/or one's legal representatives should have right to obtain information on which impact will be done, what will be the final result of education, which are “contraindications” of used methods of teaching and training, i.e. the right on fulfilling the procedure of informed consent. In other words, neuropedagogy begins with neuro-ethics.

One of leaders of modern neuro-ethics is P. Churchland (2006) and she is also the author of “neuro-philosophy” concept (Churchland, 1986, 2002; Robbins, 2015; Balaban & Gulyaeva, 2016; Razin, 2015). The program of research suggested by P. Churchland is characterized with relationship of philosophy, neuroscience and "people's psychology" for building of “scientific psychology” based on knowledge of mechanisms handling usage of machines combining biological and artificial neurons. Neuro-philosophy became a popular direction of humanitarian research. The review of related works made by V. Kuznetsov (Alekseev et al., 2015), uncovered two trends in neuro-philosophy. The first trend (“weak version”) follows to transfer the principles of natural sciences to neuro-psychology “by analogy”. The second trend (“strong version”) is aimed at building specific, utterly independent section of philosophic science that would serve as a methodological ground for interdisciplinary unification of all spectrum of neuro-science (Alekseev et al., 2015).

The fourth step was aimed at finding a principle that was relevant to the results of previous steps and allow discovering the perspectives of neuropedagogy. The results of previous steps are combined with the following points:

- the interdisciplinary nature of neuro-science's different research programs considering specification of its methods;
- existence of technical constructing of information system of different nature;
- request of ethical regulation related to constructing human mentality and corporeality.

Information-synergetic approach developed by I. Melik-Gaykazyan meets all these requirements of relevancy (Melik-Gaykazyan, 1997; Tarasenko et al., 2016b; Melik-Gaykazyan, Tarasenko et al., 2017). This approach allows to measure the spectrum of impacts occurring in the process of education (Mescheryakova et al., 2016). The necessity of such measurement may be illustrated by the following example. A book dedicated to neuro-marketing is concluded with a chapter called “Let the Buyer Be Aware” (Lewis, 2013) containing all the “antidotes” in a style of a recipe against manipulating impact on a buyer via visual means. Pedagogic theories need similar recipe as well. It is the consequence of shortage of bioethical measurement applied to whole the educational process. At the same time research of innovations and knowledge management following all the stages of creation and implementation of convergent technologies, demonstrate the presence of “semiotic attractors” (roles of which are played by bioethical models (Evdokimov et al., 2016a, 2016b; Melik-Gaykazyan et al., 2016) in self-organization of educational systems. Content of these attractors confirms the strength of bioethics' symbolism that is generated by reality of convergent technologies and reveals the perspectives of neuropedagogy in management of knowledge.

7. Conclusion

The future of neuropedagogy is related to implementation of education's adaptive function to reality that is constructed by convergent technologies. This reality initiates a new challenges (Melik-Gaykazyan, 2016) and defines the substance of professional training practically at all the areas of activity (Melik-Gaykazyan et al., 2016). At the same time reality of the present and the future is constructed by semiotic means among which visual symbolism means dominate. Such domination points at the new direction of adaptation – accommodation to saving one's own identity in the visually aggressive environment. This aggression is initiated by the powerful impact of visually represented information. The ability to deliver this impact in proportions required for pedagogical purposes is based on solution of measurement problem in humanitarian research and principles of bioethics protecting individuality. These two pillars define the conceptual novelty of neuro-science and pedagogy hybridization: constructing “semiotic attractors” of education, which form is created by symbolism's visual representation and content – by bioethics symbolism.

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