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INFORMATION AND COGNITIVE TECHNOLOGIES. MODERN EDUCATIONAL TREND

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Abstract

Information technologies have become part and parcel of our lives and education. These technologies have conventionally been mastered as part of the general informatics curriculum and used in studying a broad gamut of subjects both in the middle and higher schools. However, the sphere of technology has recently been going through substantial changes affecting the field of education as well. *Smart education and e-learning* is the most critical focus area for development, with its potential under intensive study globally. The technological platform for this focus area is made up of information-and-cognitive technologies, which are converged cognitive and information technologies. The process of cognition always implies introduction of sign systems and giving those a certain meaning (activities involving signs and symbols, semiosis effect). It is information-and-cognitive technologies and information-and-cognitive tools (such as mental maps) that are turning into the main subject on the general informatics curriculum. The authors suggest a model of cognitive information technologies involved in the learning process as a part of the informatics curriculum.

Keywords: Informatics, information-and-cognitive technologies, convergence, data, information, knowledge.

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1. Introduction

Thirty years ago information technologies entered schools and colleges to gradually change the entire learning process. Modern education today is unthinkable without informatics or information technologies, information-and-education environments.

However, one may assert that in the sphere of information there are very big changes underway primarily related to:

- further evolvement of educational IT sphere, especially towards *Smart education and e-learning*;
- awareness of the information technologies flip side, which has been traditionally associated with information security.
- emergence of convergent technologies, such as information-and-cognitive technologies.

One should go beyond the information technologies per se to take adequate account of these changes and comprehend the phenomenon of technology in the context of human transformative activity.

2. Problem Statement

Activity focused on transformation of the world is as old as the hills. This activity started gaining its contemporary traits along with the development of machine-aided production and the related changes in the intellectual and practical activities of humans.

The conceptual aspect of these changes was distinctly defined by René Descartes in his fundamental work *Discourse on the Method*. According to Descartes any activity should follow a certain procedure (a method), with this procedure directly depending on its degree of formalization for efficiency. This provision has become a fundamental paradigm of the social structure traditionally referred to as *industrial society* and fully reconstructed in information society.

Technology as a logical extension of Descartes' "method" forms the core of the said social structures in the following aspects:

- advancement to a set goal is formalized to such a degree that this advancement can be reproduced in a broad range of conditions to produce practically identical outcomes;
- it becomes possible in principle to automate manufacturing processes (this gradually permeates practically every aspect of human life).

Advance of technology is closely linked with scientific knowledge. Moreover, the ultimate goal of science (at least over the past 400 years) is the creation of technologies (Bacon, F., Hobbes, T., et al.).

3. Research Questions

At present time, however, a whole range of concepts connected with functional literacy and its main components cannot be considered as fully adopted by the worldwide scientific community. We proceed from the idea, which was proposed by N.F. Vinogradova, academician of the Russian Academy of Education, that the components of FL should be differentiated according to their role in the process of its use: integrative (communication, information, reading literacy) and subject-specific (mathematical,

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natural science, social literacy, etc.). The purpose of our research is to define the concepts which we recognize as the subject-specific components of functional literacy: language and literary literacy. We propose and give reasons for the characterization of these terms in the light of the strategic objectives of modern language and literary education in school.

4. Purpose of the Study

Specifically, modern education has been affected by the phenomenon dubbed *personal identity on-line* – a new way of building a personal identity, which exists both in the reality we are familiar with and in the virtual space where humans co-function with their *infosphere* – a sophisticated system of human knowledge about the world and a system of knowledge about these humans as a set of all sorts of facts associated with them. The cognitive process itself occurs in the framework of a new scientific paradigm, viz. *data intensive science*. This paradigm proclaims the priority of communication and social intercourse in the course of scientific inquiry over generally accepted methodologies, both theoretical and empirical (Bell, Hey, Szalay, 2009; Floridi, 2011; Rodongo, 2011; Kastels, 2000.) (Hey, Tansley, Tolle, 2009; Kim, Addom, Stanton, 2011; Sultan, 2010).

5. Research Methods

Studies by world leaders in predictive research reveal that the amount of and demand for information will be subject to exponential growth before 2020. Decision makers unable to create and handle such amounts of information will be put into a state one could describe as analysis paralysis. Thus, a major problem of modern society is information flood.

By now the direction of the main strike against an information explosion has been realized – to move from data storage and processing to knowledge accumulation and processing. That, in turn, builds a new cognitive wave, which according to many authoritative researchers is going to bring about a massive change in the way we handle information. Within such a cognitive wave emerge and evolve information-and-cognitive technologies focused on representations and knowledge processing.

It is information-and-cognitive technologies and information-and-cognitive tools (such as mental mapping) that are becoming main subjects on the general informatics curriculum (Mindzaeva, Beshenkova, Shutikova, Trubina, 2016; Beshenkov, Shutikova, & Mindzaeva, 2015). In particular, it separates data, information and knowledge in principle. In this, data are understood as facts and ideas presented in a symbolic form allowing of their communication, processing and interpretation; information is understood as meaning ascribed to data on the basis of known rules of presentation of facts and ideas; knowledge is made up of structured (linked by cause and effect and other relations) information forming a system (adequately reflecting tested and proven laws, patterns of interaction with reality) (Mindzaeva, 2013; Shutikova, 2011).

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6. Findings

Based on these fundamental concepts, one may construct a model of cognitive information technologies involved in the learning process, with this model allowing for peculiarities of modern information society.

The essence of this model, in general, is as follows.

Study of information phenomena and other phenomena of the environment (recording data signals) generates *information* about this environment, which in this context can be viewed as unity of *syntax* and *semantics*, since the process of cognition inevitably implies introduction of sign systems and giving those a certain meaning (activities involving signs and symbols, semiosis effect). This is followed by cognitive-and-information activities aimed at getting knowledge, which is naturally projected onto the learning process reflecting the cognitive process per se. However, considering the pragmatic drift of modern science (according to outstanding philosophers of the 20th century, such as M. Heidegger, K Jaspers and many others), one may argue that the notion of information has become, together with the matter, the subject of transformative activity. At a certain stage the computer emerges as a universal tool for this activity. The computer can only work with the syntactic component of information, i. e. *data*, hence, unprecedented increase in various virtual objects. On the other hand, the semantic component of information can also be subjected to transformations (e.g. in social information technologies). All this strongly swings the balance between syntax and semantics, which severely affects every aspect of human life and activity, learning inclusive. One may say that man was put "outside" the phenomenon of information, and "information per se" was focused on. Availability and velocity of information transmission are often passed off as a value in itself, while the cognitive component is being disregarded, viz. the need to compare, criticize, the ability to comprehend, evaluate, review information using scientific and philosophical inquiry to enable every human to produce new knowledge on the basis of information flow.

Regaining the balance, getting true knowledge about the world, conducting fruitful learning and practical activities becomes possible with the full-cycle cognitive-and-information activity: *data* → *information* → *knowledge*. The cycle can be also viewed as an information model of cognitive information technologies aimed at acquisition of knowledge in modern information society.

The triad *data-information-knowledge* is important for learning because it *clusters* universal learning skills (the level of basic general education) or common cultural competencies (the level of higher professional education), i. e. practically all kinds of universal learning skills (personality-related, regulatory, cognitive, communicative) or common cultural competencies contain elements of operations meant to transform data into information, information into knowledge, to use the acquired knowledge for further work with data (i. e. acquisition of metaknowledge – knowledge about knowledge and knowledge about possible ways of handling knowledge), etc.

7. Conclusion

The model is mastered as part of the informatics curriculum but the scope of this model of cognitive information technologies related to the learning process applies to education as a whole, since every member of modern information society, on the one hand, should be able to use tools for unassisted

acquisition of knowledge, and on the other hand, should be open for absorbing some ready-made knowledge. The leading part here is reserved precisely for a tool-based approach.

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