The European Proceedings of
Social & Behavioural Sciences
EpSBS

Future Academy

ISSN: 2357-1330

https://dx.doi.org/10.15405/epsbs.2018.09.02.90

EEIA-2018
2018 International Conference "Education Environment for the Information Age"

INFORMATICS DISCIPLINE IN THE CONTEXT OF DIGITAL CIVILIZATION

Irina I. Trubina, (a)*, Sergey A. Beshenkov, (b), Anna A. Braines, (c)
*Corresponding author

(a) Dr.Sc. (Education), Professor, Leading Researcher, Institute for Strategy of Education Development of the Russian Academy of Education, Moscow, Russia, E-mail: uvshp@mail.ru*
(b) Dr.Sc. (Education), Professor, Laboratory Manager, Institute of Education Management of the Russian Academy of Education, E-mail: srg57@mail.ru
(c) Educational Psychologist, All-Girls Boarding School, Russia, E-mail: braines@mail.ru

Abstract

The article offers a view on the development of the core subject of Informatics. Discussing it as a discipline pertaining to technology and science can hardly exhaust its educational potential. According to numerous philosophical, sociological and pedagogical studies informatics reflects the most significant trends of modern culture. These trends are very strongly affecting all aspects of modern civilization. It is in informatics that the conceptual framework disclosing the principal aspects of virtualization and many other phenomena of social and cultural life was established. Within the scope of Informatics one can both specifically and thoroughly explore the phenomenon of virtualization and establish a system of assignments and activities of a new type having, as it seems to us, educational and didactic value.

As of today many points of the informatics core curriculum are quite well defined. Most authors believe that Informatics does not boil down to computer science but is a fundamental science subject studying information process patterns in systems of different nature along with methods and tools for automation of these processes. In forming the instructional content a systemic condition should be met: a balanced combination of the subject-related and activity-related aspects of Informatics. However, the authors assume that the development of meta-subject content of the common core informatics curriculum certainly does not mean rejection of the science and technology aspects of informatics.

Keywords: Informatics, civilization, information, meta-subject relatedness.

https://dx.doi.org/10.15405/epsbs.2018.09.02.90
Corresponding Author: I. I. Trubina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

1. Introduction

Correlation of Informatics with a science subject imbues the former with logic inherent to this subject and representing the main stages of cognition:

- object of cognition (a phenomenon);
- cognitive tool (this is a model, as a rule);
- area of application (where results of cognition are utilized).

The studies by S. A. Beshenkov, E. A. Rakitina, M. I. Shutikova helped disclose the above triad with reference to informatics. It was shown that information processes constituted the main phenomenon representing the information component of reality, information models constituted the main cognitive tool, fields of management, technologies, social environment constituted the areas of application.

This concept underpins the 2004 General Educational Standard for Informatics (Federalny komponent gosudarstvennogo standarta obschego obrazovaniya, 2004). It documented the general education status of Informatics was for the first time, and served as a foundation for subsequent development of the informatics curriculum content for middle school.

However, the development of Informatics as the subject is far from being complete. Discussing it as a subject pertaining to technology and science hardly exhausts its educational potential. On the contrary, according to numerous philosophical, sociological and pedagogical studies, informatics reflects the most significant trends of modern culture (to put it more precisely, informatics is one of the most typical representations of these trends). These trends are quite profoundly affecting all aspects of modern civilization including the sphere of education.

2. Problem Statement

One of the most important trends of modern life may be summed up in a single term, viz. "virtualization", which boils down to the following. (Shihnabieva & Beshenkov, 2016).

Around the early 1920s there emerged a trend towards building an artificial universe that had issues with the real world. The so-called "main point of formalization" supporting the possibility of separation of the sign and the object it denotes in principle form the theoretical basis of such constructs. As F. Nietzsche once put it, "...the thought is one thing, the deed is another, and another yet is the image of the deed. The wheel of causality does not roll between them." In modern world signs and texts they form became critically important in the 20th century for science, culture and for human life at large. It was the concept of text that became one of the key concepts of the 20th century culture.

The general situation could be summed up as follows. Between man and the environment (subject and object) there is a world of sign systems representing an essential component of learning, communication, practical activities. The following features of these systems seem to be important for education.

1. Sign systems emerging in the process of learning "fracture" the solid environment around humans into separate subject areas, each having its own sign system with its syntax and semantics. However, one objective of education is teaching students the picture of the world in its entirety. The diversity of subject-related sign systems makes solving this problem quite challenging.

https://dx.doi.org/10.15405/epsbs.2018.09.02.90
Corresponding Author: I. I. Trubina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

2. Sign systems in the modern world tend to become autonomous and produce various "virtual worlds". Modern computer technologies form an ideal tool for creating such "worlds". But roaming around the virtual worlds (and more than just computer worlds) takes humans very far away from the real world, thus badly affecting both the individuals and the society at large.

Moreover, virtualization can be termed as a challenge (according to A. Toynbee) to existence of the human civilization at large because virtualization of the human conscience (as a way of thinking) "disengages" man from the real world, with potentially disastrous implications.

3. Research Questions

The system of education, it seems, has not yet produced an adequate "answer" to this trend's "challenge". There are several causes for this. We shall point out those of the greatest importance.

1. Virtualization is a potent and "soft" tool of power. The Okinawa Charter 2000 puts it this way: "Government bodies communicate with the people using information technologies". Extensive public awareness of the principles these tools function on can be raised only when there is imminent and already perceived danger.

2. The system of concepts and notions that could help disclose the meaning of virtualization has not been quite established yet. Outside this system of concepts any discussion of virtualization turns into a dull narrative about this phenomenon without understanding of its causes and effects (Shipitsin, 2014).

It seems that the core subject of Informatics could play the key role in forming the above answer. Above all, it has to do with the conceptual framework established in informatics and suitable for disclosing the principal aspects of virtualization and many other phenomena of social and cultural life.

Indeed, the conceptual framework of universal, meta-subject nature was already formed in the Educational Standard 2004 representing an approach to informatics predominantly based on science and technology. It is this framework that can be used to explain a wide range of phenomena from a great variety of human activities.

4. Purpose of the Study

To describe the concept of virtualization within the scope of Informatics in terms of meta-subject, general learning skills.

5. Research Methods

The authors used the method of text analysis during their research.

6. Findings

By way of illustration, we will refer to the Informatics curriculum content developed for middle school (Grades 8–9) as part of the Educational Standard 2004. The italics in the excerpt below mark the universal, meta-subject concepts and points.

Information and information processes.

https://dx.doi.org/10.15405/epsbs.2018.09.02.90
Corresponding Author: I. I. Trubina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

The concept of information and its role in social life and scientific cognition. Properties of information. *Language as a tool for representing information. Natural and formal languages.* Binary representation of information.

Main types of information processes.

Information collecting. Search and selection methods. *Analysis and evaluation of information properties.*

Storing. Main ways of storing information. Information storage media. Main procedures: placement, storage, retrieval. Automated information systems as information storage tools.

Transmission of information. *Information source and recipient, communication link, signal, coding and decoding, distortion of information during transmission*.

Information processing. Transformation of information on the basis of formal rules. Essential formalization of information processing as a condition of its automation.

Information security. Information security methods. *Responsibility of a citizen to maintain security of social information and individually significant information*, … etc., which was formulated in the documents referring to Informatics curriculum (Osnovy obschei teorii i medodiki obuchenia informatike, 2017; Kolin, 2015).

Therefore, the percentage of meta-subject concepts and points formed within the scope of informatics is sufficiently high. However, these concepts can hardly exhaust the potential of informatics as a "meta subject". One may conclude that inside the subject of informatics there formed quite a distinct drift towards expansion of its content into the meta-subject area. The general trend in the development of the informatics curriculum over 30 years of informatics existence as a school subject could be expressed in this way: "from computer literacy to a common core subject, from the common core subject to a meta-subject" (Beshenkov, Shutikova & Mindzaeva, 2016).

Remarkably, the said objective trend in the development of a common core informatics curriculum naturally matches the designs underpinning the New generation learning standard, which asserts that requirements for learning outcomes should achieve the personality and meta-subject level.

A few words should be said about the concept of meta-subject, general learning skills.

The issue of general learning/universal skills became especially relevant in the 1970s-1980s, when the meta-subject knowledge began to increase in volume and the children's overload became manifest. This brought about active research of the challenge of teaching children to learn and thereby decreasing their learning stress. Accordingly, in 1984, N. A. Loshkareva (1984) created a programme for development of general learning skills viewed as learners' labor skills. She identified three groups of such skills. The first group includes cognitive skills of students (sense making and setting a task on their own, planning accomplishment of the task at hand, etc.). The second group includes the skills of working with books and other sources of information. The third group in her classification includes oral and written language skills of students. She builds a developmental programme for all grades of the general education school in alignment with this classification.

The typology proposed by N. A. Loshkareva proved to be sufficiently balanced. In particular, it underpinned the typology of general learning skills proposed by Yu. K. Babansky (1988) who also identified three classes of general learning skills: learning-and-organizational skills (ability to set activities,

https://dx.doi.org/10.15405/epsbs.2018.09.02.90
Corresponding Author: I. I. Trubina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

ability to plan activities in a rational way, ability to create favorable conditions for activities); learning-and-information processing skills (ability to search for references, to work with a book, to carry out observations, etc.); learning-and-intellectual skills (motivate one's activities, make sense of the instructional material, etc.). Later on, a similar classification was adhered to by S. G. Vorovschikov (Vorovschikov & Orlova, 2012).

The concept of general learning skills regarded as general work practices of learners was naturally integral to the general concept of school education focused on learning the science fundamentals. Once society shifts into its post-industrial age, the system of education is radically transformed. The main point of the effected changes is about teaching a student not so much the fundamentals of science but rather reality interaction skills. Such interaction in general goes beyond the scope of any subject, hence, is related to the meta-subject level.

In modern literature on teaching methods the terms "meta-subject" and "general learning" (used as premodifiers) are very often regarded as synonyms. Moreover, another term "universal learning actions" (used for example in the second generation standard concept) tends to be close to the meaning of the previous terms. All this contributes to certain confusion, which, nonetheless, represents an objective change of pedagogical functions of general learning skills in their transition to a new paradigm of education encouraging students to learn various manifestations of reality.

The system of meta-subject skills seems to be determined by the following main features of the object-subject type interaction:

• the object of learning (the object of reality), as a rule, is "fuzzy", "vague", "volatile", loaded with information noise, etc.;

• the subject, i.e. students, are overwhelmingly incompetent users of tools for learning such objects;

• the contact between the subject and object is interactive, i.e. a student as the subject of cognition is involved in the process and vigorously interacts with all elements being also an active organizer of the process itself (varying activities determining also the result of the activity).

It is information processing skills that must constitute the content of the common core informatics curriculum. They form a special, central group among the identified meta-subject skills.

The drift of informatics towards the meta-level is quite objective and depends on the following main factors.

1. The above phenomenon of virtualization is the hallmark of the modern information civilization. Socialization of students in the modern world or, in general, any sensible human life or activities are impossible, unless virtualization is comprehended.

2. A surge of crisis phenomena of the modern world, which are mostly rooted in information (semiotics). It became obvious that they cannot be overcome without accumulation of certain intellectual potential conducive to generation of radically new ideas, methods, theories. This potential cannot be formed within the framework of elite education; it requires access to the level of general education.

3. The internal factor associated with the necessity of developing inter-subject communications within the system of academic subjects related to both science and art. Only then can the picture of the world in its entirety be formed in students' minds, which is undoubtedly one of the most important objectives of general education. In this context, informatics is an ideal tool for establishing such ties.

https://dx.doi.org/10.15405/epsbs.2018.09.02.90
Corresponding Author: I. I. Trubina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

Let us look at these factors more closely.

1) The primary environment for modern human activities is the so-called "information society". For a commonplace mind the "information society" is a society abounding with computers and information. In this sense ours is indeed an information society. In fact, "information society" is quite a strict social concept formulated in the works by D. Bell, A. Touraine, A. Toffler et al. To sum up the research by sociologists, the basic features of this type of social organization can be presented as follows.

a) It is scientific knowledge that must be the determining factor of social life in this society in general. This knowledge ousts labour (manual and mechanized) from its role of the factor affecting the cost of products and services. Economic and social functions of capital are adopted by information. As a consequence, the university as a facility for manufacturing, processing and accumulating knowledge turns into the hub of social organization.

b) It is the level of knowledge rather than property that must be the determining factor of social differentiation. The split between the "rich" and the "poor" shifts to a totally new ground: the privileged class is made up by the informed individuals, while the uninformed ones are the "new poor". Accordingly, the focal point of social conflicts moves from the economic sphere to the sphere of culture.

c) The primary infrastructure of the information society is made up of "intellectual", not "mechanical" equipment. The social organization and information technologies form "symbiosis".

The "information society" of this kind has not been created anywhere, despite the availability of all its basic technical, technological and economic attributes. The forecasts by theorists proved to be false primarily because they equated information and knowledge. Though widespread such a view on information is not the only option.

The communicative concept of information is the most important one in the context of the processes currently underway in modern society (Sotnikov, Katasonova & Strigina, 2015).

Modern explorers of the "information" phenomenon identify three main points in it:

- "message", i.e. the product of intellectual activity or work of art;
- "interpretation" of this message;
- "communication", i.e. the operation of signs transmission, broadcasting.

According to the above theorists, in information society things, i.e. "messages" were to transform into "interpretation", i.e. knowledge. However, in real society the intermediate component – "communication" – becomes dominant. Thus, information in modern society instead of turning into knowledge tends to be more a foundation, a motive, justification for some actions, i.e. becomes operational. That explains why instead of information resources contained in huge data banks it was Internet that became the principal phenomenon of the computer revolution. Such an approach pours light on a very vast array of social phenomena. For instance, modern advertising in general is not information support of any product, personality or action. It is not so much about transmission of product or service properties data (i.e. some knowledge about an object), as about creation of its image encouraging a certain behaviour in a person. Image creation is always about handling signs, symbols, while communication is a stream of symbols. It is remarkable that very often conflicts in the modern information civilization also arise over "symbolic benefits" as phrased by A. Touraine.

https://dx.doi.org/10.15405/epsbs.2018.09.02.90
Corresponding Author: I. I. Trubina
Selection and peer-review under responsibility of the Organizing Committee of the conference
eISSN: 2357-1330

7. Conclusion

Today, a large and ever increasing number of studies focus on the phenomenon of information civilization (as distinguished from "information society"). The above concept of "virtualization" is the key to comprehending a broad spectrum of phenomena representative of this particular society. For example, one may speak of virtual economy, politics, science, culture, etc.

Within the scope of Informatics, in particular using the above mentioned conceptual framework, one can both specifically and thoroughly explore the phenomenon of virtualization and establish a system of assignments and activities of a new type having, as it seems to us, educational and didactic value.

The drift towards development of meta-subject content of the common core informatics curriculum certainly does not mean annulment of the science and technology aspects of informatics. We believe that every stage of the continuous Informatics curriculum (Grades 2–11) has its dominant aspects.

Acknowledgements

The article has been prepared within the state task of the Institution for Strategy of Education Development of the Russian Academy of Education for 2017-2019 on the subject matter: "Updating the content of general education and teaching methods in the context of modern information environment" (Project 27.6122.2017/BP).

References

Babansky, Yu.K. (1988). *Vvedeniye v nauchnoye issledovaniye po pedagogike*. Pod red. V.I. Zhuravleva. Moscow, Prosvescheniye, 237. [in Rus.].

Beshenkov, S.A., Shutikova, M.I., Mindzaeva, E.V. (2016). Ot informatsionnykh k konvergentnym tekhnologiyam. *Prepodavatel' XXI veka.,* No. 4, pp. 86-93 [in Rus.].

Federalny komponent gosudarstvennogo standarta obschego obrazovaniya (2004). Chast II. Sredneye (polnoye) obschee obrazovaniye. Ministry of Education of the Russian Federation. Moscow, 266. [in Rus.].

Kolin, K.K. (2015). *Informatsionnaya paradigma poznaniya: aktualnost problemy Partnerstvo tsivilizatsiy*, Nos.1–2 [in Rus.].

Loshkareva, N.V., Loshkareva, N.A. (1984). *O programme razvitiya obschikh uchenbnykh umeniy i navykov shkol'nikov Loshkareva N.A. II Rol' uchebnoi literatury v formirovanii obschikh uchenbnykh umeniy i navykov shkol'nikov* Obsch. red. by Gorelov, V.V., Moscow, Pedagogika, pp. 13-19 [in Rus.].

Osnovy obschei teorii i medodiki obuchenia informatike: uchebnoye posobie pod red. A. A. Kuznetsova, 2nd ed. (el.) (2017). Moscow, BINOM, Laboratoriya znaniy, 207. [in Rus.].

Sotnikov, A.D., Katasonova, G.R., Strigina, E.V. (2015). *Analysis of modern education system based on Domain Model of Infocommunications Fundamental Research*, No. 2–26, pp. 5930–5934.

Shihnabieva, T.S., Beshenkov, S.A. (2016). *Intelligent system of training and control of knowledge, based on adaptive semantic models the Smart Innovation, Systems and Technologies series*, V. 59, Springer Verlag, pp. 595-603 (Scopus).

Shipitsin, A.I. (2014). *Sotsialnie seti v kontekste virtualizatsii sovremennoi kultury*: PhD thesis: 09.00.13 Shipitsin, Anton Igorevitch. Volgograd, 161. [in Rus.]. – URL: http://www.dslib.net/religio-vedenie/kompjuternye-socialnye-seti-v-kontekste-virtualizaciisovremennoj-kultury.html

Vorovschikov, S.G., Orlova, Ye.V. (2012*). Razvitiye universalnykh uchebnykh deistviy vnutrishkolnaya Sistema uchebnometodicheskogo I upravlencheskogo soprovozhdeniya : Monografia*. Moscow, MPGU, 210. [in Rus.].