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Informatization of Education in Kazakhstan: New Challenges and Further Development of Scientific Schools

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ABSTRACT

The purpose of the paper is to identify trends and systematize theoretical approaches developed in the theory of education of Kazakhstan; to review and summarize new global challenges, related to the informatization of education. The trends of the large-scale updating of the content of education, dinamizing of the education process, diversification of education within the framework of the mega trend of the informatization of education were identified. The problem of the transition from the generation of the 20th century to a new generation, from receiving knowledge by reading or from a teacher's monologue to the visual perception, dialogue or polylogue in the audience, was put in the forefront. These challenges should be explored by scientists. The continuity of didactic paradigms was described: Behaviorism→cognitivism→constructivism→connectivism. It was found that about 30% of the scientific research in the field of education, conducted in Kazakhstan, are explicitly focused on the study of the informatization of education. More than 35% of thesis researches are also explicitly focused on studying IT as their subject. Scientific schools in the field of the informatization of education in Kazakhstan, covering different regions of the Republic, were listed and summarized. It was found that in the Republic there are virtually no studies on thepsychological changes in thinking, memory, and attention in the process of active electronic and mobile teaching of a child.

Keywords: Informatization of Education, Scientific Schools, Connectivism, Digital Technologies
JEL Classifications: I20, I23, I26

1. INTRODUCTION

Informatization of the society is often understood as the introduction of IT-technologies in the education process. According to the theory of information society, informatization includes, first of all, growth of information and knowledge, and only after that - The introduction of IT-technologies in all the areas of society.

There are several large scientific schools in the field of the informatization of education in Kazakhstan. However, these studies are almost not presented in English. The study used the following methods: Synthesis and comparison of the research conducted by Kazakh scientists in the field of informatization, critical analysis and classification of the areas of research (doctoral and master's theses, collection of research and development (R&D) abstracts, articles, scientific projects), the comparison of the directions of research of Kazakh scientists with the global trends.

2. INFORMATIZATION AS A GLOBAL TREND IN THE DEVELOPMENT OF EDUCATION

The increasing number of information sources results in the faster pulsing of information, which serves the purpose of the maintenance of the integrity of the system (Toffler, 1981). In other words, according the theory of information society, previously the main source of information and knowledge wasa teacher or a priest, while now the sources of information are teachers, numerous textbooks and books, media, Internet, students themselves, etc., that generate information and knowledge from a variety of sources. To maintain the integrity of the system, the

acceleration of the information exchange takes place. The modern society is characterized by the three key properties of information: Novelty, dynamism and diversity. Let us extendthis Toffler's understanding to the contemporary education.

Novelty→develops into: (1) Updating of education paradigms, (2) updating of the content of education. This is manifested both in the updating of knowledge and theoretical concepts in each of the disciplines, and in the emergence of new disciplines. New educational programs emerge, (3) Updating of the forms and methods of teaching, etc.

Dynamism→dictates the pace of updating knowledge, accelerating the process of learning itself, exchanging information in theprocess of learning, etc.

Diversity→results in the diversification of education, which is expressed in the diversification of educational institutions, funding sources, as well as the diversification of educational programs, curricula, courses, etc. (Mynbayeva, 2001).

Novelty, dynamism and diversity are the key properties of information, which directly affect the content, methods and forms of education. This is the global manifestation of the trend of theinformatization of education. Thus, this trend is manifested in updating the content and methods of education, dinamizing of education, the diversification of education.

Reasoning from the practice, the analysis and synthesis of changes indicates the manifestation of informatization of education in several properties: (1) Growth of information and knowledge; (2) development of information culture⇨information competence; (3) development of computer literacy; (4) the use of IT and computers in the learning process; (5) the use of digital and mobile technologies.

In the former Soviet Union, the discipline of computer science was firstintroduced in secondary schools in 1986. For didactics as a science, it is important to understand the depth and different aspects of the impact and penetration of informatization: Content and methods of education, teaching aids. That is, IT and computers were studied as a subject = discipline, which characterizes the expansion of the content of education. Next, computers, netbooks, projectors, smart boards, electronic digital desks, digital podiums are used as teaching aids. Modernmethods of teaching include working with electronic textbooks, training programs, computer games, the Internet, etc. New forms of education include distance learning, online courses, e-learning, digital and mobile learning. Computer and IT technologies are also widely used to administer and manage the education process. At higher education institutions, a teacher and a student can have their electronic office.

Studying computer science at school resulted in the high level of computer literacy of the population. According to the Committee on Statistics of the Ministry of National Economy of the Republic of Kazakhstan, 99.9% of the population aged 16-74 years old have basic computer skills (2014). On the one hand, this is a result of the introduction of the subject in school, on the other hand, this is a new stage for the development of the informatization of education.

3. RESULTS

3.1. Research on the Informatization of Education in Kazakhstan

Research in the field of ICT is conducted as: (1) Funded projects: Research projects supported by the grants of the Ministry of education and science of the Republic of Kazakhstan/MES RK, contractual projects and self-financed projects of universities, international projects; (2) doctoral and master's theses.

Abstracts of the funded research projects can be foundin the Collection of R&D abstracts, which is also called the abstract journal. A study of the abstract journal of Kazakhstan makes it possible to determine that, if we take all the projects of the Ministry of education and science of the Republic of Kazakhstan in the field of education as 100%, then approximately a third part of the research projects, implemented in 2011 in the field of education and included in the abstract journal (collection of research and development abstracts, 2012-2014), were related to computerization and ICT. There are four main directions of research: (1) Teaching of Informatics, (2) training of IT specialists, (3) using IT in training students (not IT specialists), (4) creation and development of information resources, environments, etc. On the basis of the criterion of the performers, funded R&D projects can be divided into projects implemented by the National Academy of Education named after Altynsarin as a scientific institute, and university projects.

The analysis of the report on the research activities of higher education institutions, in particular, the Al-Farabi Kazakh National University (Research Report of the Al-Farabi Kazakh National University, 2014), shows that there is a large number of international research projects on the informatization of education. For example, 40% of the Tempus (ERASMUS +) projects, implemented at the Al-Farabi Kazakh National University, are related to the field of the informatization of education.

The analysis of the abstract journal of the theses, defended in 2010, made it possible to identify 4 directions of the research on the informatization of education: (1) IT in teaching mathematics, physics, astronomy, foreign languages, decorative art, statistics, agriculture, etc.; (2) training of IT specialists and teaching specialized IT disciplines (e.g., operating system administration, computer graphics, etc.); (3) managing a higher education institution, development of methodologicalportals, information and administrative resources of schools, etc.; (4) distance education. Besides, if we take all the studies on public education as 100%, 35% of them are works related to the informatization of education.

4. SCIENTIFIC SCHOOLS OF KAZAKHSTAN IN THE FIELD OF THE INFORMATIZATION OF EDUCATION

A scientific school is an informal scientific community, characterized by "teacher-students" relationships, determining the continuity of the subjective (personal) and objective components of their scientific activities (Grezneva, 2003). Scientific schools are organized and managed scientific structures, united by a certain

research program and single style of thinking, and, as a rule, led by outstanding scientists (Leshkevich, 2006). A scientific community is not a single structure, but a "granular environment." Everything significant for the development of scientific knowledge is contained inside a "granule" - A cohesive scientific group, which collectively creates a new element of knowledge, and then promotes it inthe struggle and compromises with other similar groups (Rozov, 2007). Relying on the criteria of "teacher-student" relationships, as well as the common direction of scientific research, let us identify the scientific schools of Kazakhstan in the field of the informatization of education. Having studied the monographs and abstracts of Bidajbekov et al. (2006), Dzhusubalieva (1997), Nurgaliyeva and Artykbayeva (2010), Nurbekova (2007), Sagimbayeva (2010), Tazhigulova (2009), Shkutina (2002) and others, let us summarize the existing scientific schools in Table 1. It presents only some of the scientific schools of leading Kazakhstani scientists dealing with theinformatization of education.

The studies combine the "Modeling" of information training or readiness to work with IT, electronic textbooks, e-learning. "Modeling" as a method and the development of theoretical models is a specific feature of the pedagogical scientific school of Kazakhstan. Besides, within the framework of the studiesa variety of electronic products were developed - Training programs, electronic books, multimedia tools, etc.

There are new research works in English: Sapargaliyev and Shulenbayeva (2013), where an attempt was made to briefly describe the studies of Kazakh scientists on the informatization of education; Kenzhebayev and Dalayeva (2014) provided a review of the development of e-learningin Kazakhstan. The issues of the systematizing of the development of ICT, including technical equipment and software, in comparison with the CIS and Baltic countries, are exhaustively covered by Nurgaliyeva in the report on the use of the ICT in education, prepared by the UNESCO Institute for Information Technologies in Education (2009). The report raises issues of public policy, government regulation ofthe informatization of education, the need to improve the legislation of Kazakhstan in the field of distance education.

5. DISCUSSION

The critical analysis of the directions of scientific research in the sphere of informatization showedthe lack ofstudies on psychological specifics of the informatization of education in Kazakhstan. Figuratively speaking, the studies deal with external issues, the issues of the organization or structuring of education. And what are the changes in thinking, emotional perception, inner world of a person?

There are virtually no works studying "connectivism as a new paradigm of didactics." In foreign literature and on foreign websites (Siemens, 2006; Brdička, 2012) there is a discussion of a new didactic paradigm called "connectivism." As the researchers note, connectivism has not yet become a coherent theory, but it has new conceptual foundations. Brdička in 2012 systematized the development of the didactic paradigms in the 20th century in the following way: Behaviorism→cognitivism→constructivism →connectivism (Table 2).

The theory of behaviorism, or behavioral approach, is known to emerge in the 1920s. This theory has beenused in education for a long time. The schools of the 18th-19th century, though they did not

Table 1: Scientific schools of Kazakhstan in the field of the informatization of education

Head of the school	Doctoral and master's theses
National Center of Informatization	The methodology and technologies of informatization at all the levels of education: Higher vocational education (Akhmetova, Makatova, Taulanov)
The scientific school of Nurgaliyeva	• Secondary vocational education (Bekturganov, Kurmanalin) • General secondary education (Tazhigulova, Artykbayeva), etc. For example, in 1997 Doctor of Pedagogical Sciences Dzhusubalieva "Formation of the information culture of students in distance education." Doctor of Pedagogical Sciences Tazhigulova, 2000 - The master's thesis "Pedagogical principles of designing electronic textbooks," 2009 - doctoral thesis "The methodology and technology of the informatization of secondary education." Doctor of Pedagogical Sciences Artykbaeva, 2010 - Doctoral Thesis "Theory and Technology of E-learning in Secondary School"
The scientific school of Bidajbekov	Development of the methodical system of teaching computer science • Theoretical and methodological basis of the proactive teaching of programming (Nurbekova) • Improving the teaching of computational informatics (Kamalova) • Evaluation of quality of digital resources on informatics (Usenov) • Electronic assessment of academic achievements (Sagimbayeva)
Scientific school of Egorov	Informatization of engineer training • Designing activity of an engineering teacher on the basis of IT (Shrajmanova) • Training of IT professionals (Golovacheva) • Information and mathematical training of technical students (Abdygalikova), etc.
Scientific school of Shkutina	Improvement of professional training on the basis of the integration of IT and pedagogical technologies • Didactics of the formalization of knowledge and skills on the basis of IT (Tazhigulova) • Multimedia tools in educational work (Aubakirov) • Improvement of practical training (Tursynova) • IT and practical training of a Bachelor of transportation (Kurymbaev), etc.

Table 2: Connectivism as a new didactic framework in the foreign theory of education (Ph.D. Ing. Brdička, 2012)

Theory/Criteria	Behaviourism	Cognitivism	Constructivism	Connectivism
Source of knowledge	Experience	Reason and experience	Reason	Connection
Principle	Black box - External behavior reflected	Placement of Knowledge to brain	Personal activity, Individualization	Knowledge as collective product
Motivation	Positive/negative reinforcement	Marks, diploma	Own interest	Interest supported by community
Process	Repeated external sensual experience	Knowledge is interpreted	Knowledge is constructed through thought	Active network cooperation
Representatives	Skinner, Thorndike, Pavlov, Watson	Vygotsky, Bruner, Gagne, Ausubel	Bandura, Piaget, Bruner, Dewey, Papert	Siemens, Downes

directly relyonthe theory of behaviorism, rested upon the principles of the behavioral approach. The school of cognitivism developed in the 1930s. Soviet didactic system was largely basedon the use of both theories. The theory of constructivism evolved in the second half of the 20th century. In our view, using this theory in education is related both tothe need of the socialization of an individual in the society, the need for the development of socialization skills in every person, and to teaching students the skills of independent structuring of knowledge. Social constructivism focuses on the processes of the socio-psychological construction of society through personalactivity. This approach is associatedboth with the construction of the learning environment, including the communication environment, and withthe construction of knowledgethrough it. The theory has common pointsor common principleswith the cognitive theories ofboth J. Piaget (assimilation and accommodation) and Vygotsky (zone of proximal development, zone of actual development). Currently, the theory has been updated by using active and innovative teaching methods in education (brainstorming, case studies, groupmethods of teaching, etc.). It should be emphasized that the sequence of the appearance of these theories is such that each of them, in principle, does not reject the previous one, but complements it, is built on the basis of the previous theories. Such understanding illustrates the modern methodological principle ofscience studies – the principle ofcomplementarity. We use these theories for organizing the education process both in school and in higher education.

A new direction for the emerging theory was proposed by Siemens and Downes in connection with the development of network communications and new opportunities for their use in teaching (Table 2). Knowledge is now obtained through interaction with the network community. Of course, such a process of receiving knowledge, on the one hand, may be characteristic of an already prepared oradult person who is able to critically assess, analyze, select and design knowledge, that is, has a certain foundation of knowledge. At the same time, middle school studentsin the process of informal learning demonstrate activeacquisition of knowledge and skills in this way - through the networks. Therefore, we can predict that this theory will gradually extend to lower grades (even to primary school). Networks have already become an everyday occurrence for primary school children and teenagers, so their skills ofworking in the networks are often developed much better than the teachers' skills.

The scientists Don Tapscott, Diana Oblinger, Brdička also note major changes in perception and in the education process (Table 3).

Table 3: Cross-generational development (Don Tapscott, 1998; 2008; Diana Oblinger, 2005; Ing. Brdička, 2011)

Old generation	Next generation
Book→reading	Display→viewing
• Fluid pace	• Non-linear pace
• Mono-tasking	• Multi-tasking
• Linear approach	• Hypermedia
• Perception by reading	• Iconic perception
• Independent	• Connecting
• Ambitious	• Cooperation
• Passive	• Active
School as requirement	• School as game
• Deliberation	• Alert
• Reality	• Fantasy
• Technology external	• Technology internal
• Knowing facts	• Knowing how to find fact

We agree with the scientists Don Tapscott; Diana Oblinger, Ing. Brdička in that we now observe the transition from the generation of the 20th century to a new generation, from receiving knowledge by reading or from a teacher's monologue, to the visual perception, dialogue or polylogue in the audience. Teachers hold diametrically opposing views, from conservative (it is necessary to leave things as they are, to teach schoolchildren in the same way as in the 20th century) to the recognition of the need for the completerestructuring of the education system. Our position is based on the principle of ambivalence, continuity of "traditions→innovation," the need for the active study of the phenomenon of electronic and visual culture and the influence of visual culture on the personality of a secondary school student.

Digital technologies are changing our way of life, ways of communicating and thinking, our feelings, channels of influence on other people, social skills and social behaviour. The high-tech environment - computers, smart phones, video games, web search engines - is reshaping the human brain (Myamesheva, 2015). According to Small, the hi-tech revolution has its advantages. This relates to the reaction rate, rate of data processing, intelligence and decision-making (Table 4). The disadvantages of the hi-tech revolution are associated with the nature of thinking, contacts, attention and memory, friendship, stresses, ways of solving tasks (Small and Vorgan, 2014).

In the domestic didactics, there is a discussion on the fact that students read fewerbooks and get more information from the Internet, social networks, and television. The short-term

Table 4: Advantages and disadvantages of the high-tech-revolution (Small)

Advantages of the high-tech revolution	Disadvantages of the high-tech revolution
1. Reaction rate: Email, video games, search in Google teach to respond faster to visual signals and improve attention 2. Data processing: The brain adapts to rapid processing of the daily information flows, coming from everywhere, and forms special neural networks capable to grasp relevant data on the fly 3. Intelligence: New technologies develop the mind in the same way as learning new languages and resolving puzzles do, serve as a means of prevention of senile dementia and a driver of rapid growth of the IQ of an average individual 4. Decision-making: Searching for necessary information on the web on a day-to-day basis trains brain centers, associated with decision-making and logic, so the way out of any difficult situation in everyday life is found faster	1. Thinking: Thinking becomes fragmented, reading becomes superficial, the ability to concentrate and contemplate reduces, people turn into "decryptors of information," the capacity for abstract thinking is lost 2. Contacts: The basic mechanisms of controlling contacts with other people are lost, it becomes increasingly difficult to guess emotions and read others people's facial expressions during conversation 3. Attention becomes distracted, monitoring everything at once does not make it possible to concentrate on something specific 4. Real friendship is displaced by a surrogate, online friendship creates an illusion of a close connection, and loneliness is felt during real-world face-to-face communication with people, when all the gadgets are turned off 5. Multitasking is the ability to handle multiple tasks simultaneously: To listen to music, write in a blog, read e-mail. But excessive multitasking makes the job less effective, increasing stress and attention deficit 6. Memory becomes superficial and short-term, computers and the Internet have turned into a kind of "prosthesis" of memory, memory is almost never used, an individual remembers not the information, but the place of its location on the computer (the folder where it is) 7. Stress: Fatigue caused by the long immersion in the digital world results in a new form of stress - "digital haze" - techno genic brain-fag

memory of schoolchildren and students is overloaded, and there is the need to developnew methods of the consolidation of knowledge in the long-term memory, of the development of competences. Teachers raise the problem of the development of "the clip thinking" of schoolchildren. These issues put forward new requirements to teachers and their professional activity. Teachers need to master new information technologies more actively. Besides, there is a need for new studies in the field of psychology of perception and thinking in the context ofthe active use of e-learning. The issue of the practical training of teachers in the field of ICT and digital resources, the integration of such courses in the educational programs for teacher training, is also relevant.

Let us consider the Table 5 provided by the researcher Kukharenko. It presents the history of the emergence of new IT technologies and illustrates the reliance on certain didactic schools.

Table 5: Overview of the pathways of the development of e-learning (Kukharenko, 2014)

Years	Technology	Pedagogical theory
1980	Multimedia resources	Remote courses on the basis of behaviorism and cognitivism
1993	Web	
1994	Learning objects	
1995	LMS	
1998	Mobile devices	
1999	Instructional design	
2000	Game technologies	Remote courses on the basis of constructivism
2001	OER	
2004	Social media Web 2.0	
2005	Virtual worlds	
2007	E-books and smart devices	
2008	cMOOC	Remote courses on the basis of connectionism
2010	Learning analytics	
2011	MOOC	

LMS: Learning management system, MOOC: Massive open online courses, OER: Open educational resources, cMOOC: Connective massive open on-line course

This range of IT-technologies is used in Kazakhstan education. For example, the Moodle platform is used for distance education in many higher education institutions of Kazakhstan. The examples of usingsocial media Web 2.0 are, for example, some schools of Astana and Ust-Kamenogorsk, where teachers give lessons using social networks; Nazarbayev Intellectual Schools - nis.edu.kz. Besides, groups of graduate students of the Republican Institute for Development of Leading and Research-Pedagogical Staffcreate their pages in social networks and continue professional communicationafter the completion of the course. There are also online communitiesfor students and graduates. Anew direction in distance education, which is currently introduced in Kazakhstan, is the development of massive open online courses. This technology was used in the designing of the virtual academy for pupils of the Al-Farabi Kazakh National University, the open courses of the summer semester, recording lectures of invited professors. Every teacher who has an interesting course can record itat a special department of the University. However, technologies based on connectivism, have not become widespread yet, both in terms of development and application.

A new challenge is the need to develop new courses using these techniques. The approaches are characterized by essential novelty. The content of education is to be updated, wherein the study of priority technologies can become a module in the teacher training.

6. CONCLUSION

The changes, which currently take place in the post-industrial society, substantially alter the life environment of people, which is called information environment, using the term coined by Toffler. The mass introduction of the subject "computer science" in secondary schools from 1986 contributed to reaching the modern level of development and almost 100% computer literacy in the country. The ongoingdevelopment and introduction of new IT

technologies results in changes in the philosophy andtheory of education, as well as the used techniques. In the modern theory of education it is necessary to integrate the ideas of several didactic paradigms: Behaviorism→cognitivism→constructivism→connectivism. The issue of "cross-generational development" is also important: From the reading generation of the 20th century to the generation of the 21st century, which receives a growing flow of visual information. The issues of psychological measuring of the changes in thinking, perception and memory ofmodern schoolchildren, learning with the help of ICT, electronic and mobile devices, also warrant active study. This line of research should receive special attention.

It is important to realize the intense dynamics of such changes, since the history of the Internet extends back only 20 years. Currently, education is virtually unthinkable without the Internet, multimedia technologies, international databases, electronic and digital resources.

The issue of designing teacher training academic disciplines of the informatization ofeducation is also very important. Such a course can include data about scientific directions of informatization and scientific schools, conducting mini-studies on the use of ICT, e-learning at schools.

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