IMPLEMENTATION OF INFORMATION AND COMMUNICATION TECHNOLOGY IN EDUCATIONAL SYSTEM OF KAZAKHSTAN: CHALLENGES AND OPPORTUNITIES

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Abstract. Information and Communication technologies (ICT) play a significant role in the educational process becoming a powerful tool of interaction between teachers and students; computer applications are used to present useful teaching resources and to improve knowledge of students.
This article aims to examine the educational policy of the Republic of Kazakhstan within the framework of Information and Communication technology implementation. In this regard, we analyze the level of computerization of schools and universities in Kazakhstan, the teachers' competencies, and computer literacy of population. Based on data and information from official documents, reports, and official sources of education, we concluded that the Government of Kazakhstan tries to create the "digital society" and to increase the quality of education using ICT.
The results of the analysis reveal that Kazakhstan make greater effort on using ICT in the education process and the policy is aimed at increasing the number of computers in schools, opening new specialties at the universities related to information and communication technologies, as well as enhancing computer literacy of the population. However, due to the lack of funding and the comprehensive work on the training and retraining of teachers, the low speed of the Internet in some regions of the country, this process needs to be improved.
Keywords: Education, Digitalization, E-Government, ICT competencies
JEL Codes: I28; I21

Аңдатпа. Ақпараттық-коммуникациялық технологиялар (АКТ) білім беру процесінде маңызды рөл атқарады және олар оқытушылар мен оқушылар арасындағы өзара әрекеттесудің қуатты құралына айналуда; компьютерлік қосымшалар оқытудың пайдалы ресурстарын ұсыну және студенттердің білімін жетілдіру үшін қолданылады.
Бұл мақалада Қазақстан Республикасының ақпараттық-коммуникациялық технологияларды енгізу аясындағы білім беру саясаты қарастырылған. Осыған байланысты мақалада Қазақстандағы мектептер мен университеттерді компьютерлендіру деңгейі, мұғалімдердің құзыреттілігі, сондай-ақ халықтың компьютерлік сауаттылығы талданады. Ресми құжаттардан, есептерден және білім берудің ресми көздерінен алынған мәліметтер мен ақпараттарға сүйене отырып, авторлар Қазақстан үкіметі АКТ-ны «цифрлық қоғамды» құру және білім сапасын арттыру үшін қолданады деген қорытындыға келді.
Талдау нәтижелері көрсеткендей, Қазақстан АКТ-ны білім беру процесінде қолдануға көп күш салуда, ал тиісті мемлекеттік саясат мектептердегі компьютерлер санын көбейтуге, университеттерде ақпараттық-коммуникациялық технологиялармен байланысты жаңа мамандықтарды ашуға, сонымен қатар халықтың компьютерлік сауаттылығын жетілдіруге бағытталған. Алайда, қаржыландырудың жетіспеуі және мұғалімдерді даярлау мен қайта даярлау бойынша кешенді жұмыстардың болмауы, сондай-ақ елдің кейбір аймақтарында Интернет жылдамдығының төмендігі салдарынан бұл процесс әлі де жетілдіруді қажет етеді.
Түйін сөздер: білім беру, цифрландыру, электронды үкімет, АКТ құзыреттіліктері.
JEL кодтары: I28; I21

Аннотация. Информационные и коммуникационные технологии (ИКТ) играют значительную роль в образовательном процессе и становятся мощным инструментом взаимодействия учителей и учеников; компьютерные приложения используются для представления полезных учебных ресурсов и улучшения знаний учащихся.
В данной статье рассматривается образовательная политика Республики Казахстан в рамках внедрения информационных и коммуникационных технологий. В связи с этим в статье анализируется уровень компьютеризации школ и вузов в Казахстане, компетентность учителей и компьютерная грамотность

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населения. Основываясь на данных и информации из официальных документов, отчетов и источников образования, авторы пришли к выводу, что Правительство Казахстана с помощью ИКТ стремится создать «цифровое общество», а также повысить качество образования.
Результаты анализа показывают, что Казахстан прилагает большие усилия для использования ИКТ в учебном процессе, а образовательная политика направлена на увеличение количества компьютеров в школах, открытие в университетах новых специальностей, связанных с информационными и коммуникационными технологиями, а также на повышение компьютерной грамотности населения. Однако из-за отсутствия достаточного финансирования и комплексной работы по подготовке и переподготовке учителей, низкой скорости Интернета в некоторых регионах страны этот процесс все еще требует доработки.
Ключевые слова: образование, цифровизация, электронное правительство, ИКТ-компетенции.
JEL коды: I28; I21

1. INTRODUCTION

The revolutionary development of digital technologies has changed the overall view of the quality of human life and has changed the priorities of socio-economic development. The changes set the new requirements to the educational process and to the system of education. The main goal of the system of education at this stage of development is to teach the students to acquire academic skills and knowledge making them competent to use these practical skills in everyday life and this approach leads to the formation of functional literacy of students.

In this context the use of ICT provides the building up of high-quality information and educational environment to solve complex tasks, and consequently this will result in increased demands to the professional competencies of teachers. These skills of any teacher as an adequate level of digital literacy and knowledge to use ICT will increase the level of thinking and involvement of students and will develop creative and individual competencies. The students will not only demonstrate their knowledge, but they will be able deal with current and upcoming technological challenges.

The most used ICT devices in the educational process are as follows: computers, tablets, interactive multimedia devices, electronic textbooks and multimedia tools, video-audio equipment, online educational resources etc. Thus, ICT equipment can not only complement education, but also enrich and transform it for *better (UNESCO, 2003).* However, if the necessary educational environment is not created and effective tasks for using ICTs are not formulated, then the ICT presence will not be able to affect he students' quality of education.

As a matter of fact, it is important to consider all the aspects for high-quality implementation of informatization process in the educational system and e-learning. Government measures to introduce ICT into the educational process should include not only the material and technical provision of schools and the building of an appropriate infrastructure, but in addition to above-mentioned - the availability of an adequate competencies of teachers and the necessary educational content and teaching methods.

The main aim of this research is the current situation of informatization of the educational system of the Republic of Kazakhstan and the challenges of this program implementation Therefore, the paper is going to answer for the following questions:

1) How does the Government of Kazakhstan deal with Information and Communication technologies in educational system?

2) To what extent does implementation of ICT impact on the quality of education?

2. MATERIALS AND METHODS

The method of this study is comparative analysis in the field of informatization of the system of education of Kazakhstan. For this reason to conduct this analysis of informatization of the educational system of Kazakhstan the official documents were studied: the State Program of Informatization of Secondary Education System *(1997)*, the Concept of Informatization of System the Education of the Republic of Kazakhstan for 2002-2004 years, the State Program of Education Development for 2005-2010 years, the State Program of Science and Education Development for 2020-2025 years, OECD Country Review: Effectiveness of Resources use in schools of Kazakhstan *(2015)*, National reports of development Kazakhstani system of education, and also

the articles concerning the digitalization of educational system of Kazakhstan.

3. RESULTS

The results of this analysis are presented in logical sequence, starting from the review of the state policy on the implementation of ICT in the system of the secondary education; the teachers' competencies for the use of ICT in the process of education; the process of ICT use in schools; and academic results of the students. The authors also describe the process of teacher training by higher educational staff institutions for digital economy and IT spheres of Kazakhstan.

3.1. GOVERNMENT POLICY OF DIGITALIZATION OF EDUCATIONAL SYSTEM IN KAZAKHSTAN

In 2017, the State Program "Digital Kazakhstan" was launched, the goal of which was to improve the quality of life of the population and to increase the rate of economic growth through the introduction of digital technologies *(Digital Kazakhstan, 2017).* According to researchers, in this program the special attention was paid to the digital transformation of society, the creation of a digital industry, infrastructure, and the development of the social sphere, and begins the process of deep digitalization of the education system *(Jussupova, Bokayev, Zhussip, 2019).*

The government consider the ICT as "a main tool for building knowledge society", as well as an effective mechanism promoting the rethinking and change of educational systems and processes, what will lead to an increase in the quality of education for all i.e. meritocracy *(UNESCO, 2003; Sangrà & González-Sanmamed, 2010).* Consequently, in Kazakhstani system of education the actions are taken to develop and implement ICT in educational process.

The experts divide the informatization of the educational system into five main stages that are characterized by adoption of strategic and program documents, amending legislation in the system of education, implementing the new educational approaches and innovative solutions *(Jussupova, 2019).*

The first stage of informatization of the educational system is marked by the adoption of the State program of informatization of Secondary Education system in 1997. The main indicator was the large-scale provision of schools with modern computer equipment and technology *(State Program, 1997).*

During the second stage of computerization of the system of education there was the improvement of mechanisms of assessing students' learning outcomes by creating information systems for conducting a Unified National Testing, comprehensive testing of applicants, and an external assessment of academic achievements. This measure made it possible to ensure the transparency of entrance examinations to higher educational institutions, and to improve the quality of external control of academic results.

The third stage was indicated by the adoption of the Concept of Informatization of the Educational System of the Republic of Kazakhstan for 2002-2004 years and the main purpose was to create a unified educational information environment in the Republic of Kazakhstan *(Concept, 2002).* Active development of electronic educational resources, equipment of educational institutions with interactive equipment and multimedia language laboratories started in the country. For the first time, educational technologies, classroom management systems (CRMS) and learning systems (LMS), and electronic learning resources to study Kazakh, Russian and English begun to be introduced into the educational process.

The fourth stage of informatization of the system of education was from 2005-2010, when Kazakhstan first adopted the State Program for the Development of Education for 2005-2010, and the strategic plan for its implementation. The program provided for the equipping of schools with interactive classrooms and whiteboards, and the development of a unified site for interactive online lessons. At this stage, 44.6% of the country's schools were equipped with interactive equipment, what allowed conducting weekly interactive lessons at the country level in real time mode *(State Program, 2004).*

The fifth stage is associated with the adoption of the STATE PROGRAM "DIGITAL KAZAKHSTAN" in 2017, when the revision of the training system with higher and postgraduate education and with the spectrum of educational institutions with

the aim of reorienting to the digital economy was launched. Due to this document, in the universities of Kazakhstan, high-quality new educational programs with a digital and IT direction appeared.

However, according to experts' opinion, in the educational system of Kazakhstan there are a few systemic problems that impede the full and high-quality implementation of informatization of education:

1. A large number of students in one class-set, what directly influences on the quality of the educational process;

2. High demand among students for additional training due to the limited resources and infrastructure;

3. The relatively low salaries of teachers and their significant extracurricular workload associated with the organization of the educational process and the assessment of student learning outcomes;

4. Lack of effective mechanisms for advanced training and retraining of teaching staff;

5. A high level of bureaucratic processes that impede the timely adoption of managerial decisions, and, moreover, a low level of transparency of educational processes *(Jussupova, 2019).*

At the same time, in 2020, the sixth stage of modernization of the education system began, associated with the adoption of the State Program for the Development of Education and Science of the Republic of Kazakhstan for 2020 - 2025. The plan of this program will contribute to improve the use of Information and Communication Technologies in the system of education. So, one of the tasks of the Program is to equip the educational institutions with a digital infrastructure and modern logistics *(State Program, 2019).*

3.2. INFORMATION AND COMMUNICATION TECHNOLOGIES IN KAZAKHSTANI SYSTEM OF SECONDARY EDUCATION

The scholars consider that the use of ICT in education 3 times intensifies the educational process, 2-3 times improves the quality of training. The introduction of ICT in secondary education reduces the social gap between students as far as it provides equal access to high-quality education, regardless of the location of educational institutions. In Kazakhstan, 79% of the total number of schools are located in rural areas, and 55% of schools are small and located in remote rural areas.

In this regard, the Kazakhstani system of education prioritizes the introduction of the latest educational technologies in the learning process. The state has adopted important technological mechanisms for creating digital education, strategic approaches for introducing information and communication technologies into the educational process. At the system level, measures are being taken to logistically equip educational institutions, develop content and information systems for e-learning, and prepare an appropriate training for teachers and school and college leaders. Measures to introduce e-learning are taken to include more than 90% of schools and colleges by 2020 (by 2015 it was planned more than 50% of schools). Along with the digital content, various information and communication and educational platforms such as "Kundelik", Bilimland, Bilim book and others are also being developed to be used in the future *(IAC, 2019).*

Due to all these steps, today 99% or 7,332 schools (out of a total of 7,393 schools) have access to the Internet, 7,284 of them have broadband Internet with a speed above 512 kbit/s. There are schools with Internet speed - 4 Mbit/s and higher. Today, the number of such schools reaches 6,959 schools (2018 - 6,338), or 94% of all schools *(IAC, 2019).* Most regions of the country provided their schools with uninterrupted access to the Internet. However, there are a few regions such as Atyrau, West Kazakhstan, Kostanai, North Kazakhstan and Turkestan, where they still experience lagging in the level of Internet connection *(NEBD, 2019).*

Analysis of the logistics of educational institutions showed that today only 334,848 computers are installed in schools in the country. As we can see, the ratio is an average 10 students for one computer. The study revealed regional differences in the technical equipment of schools. For example, in Turkestan region the number of computers in schools is 29 304 units, it is an average 16 people per computer, in neighboring Shymkent there are 23 people per computer, and the total number is 8 880 computers. The same situation is in Nur-

Sultan and Akmola region. So, if in Nur-Sultan the number of computers is 8,584 units, an average 20 students per computer, then in the neighboring Akmola region the number of computers in schools is 13,310 units, 9 students per computer, respectively. At the same time, attention should be paid to the number of schools and children in each region of the country, since their number significantly affects the level of ICT coverage. For instance, the number of schools in Shymkent is 156 units, in the Turkestan region - 919, in Nur-Sultan - 112, and in the Akmola region - 579 units. In fact, the contingent of students in Shymkent is 200 275 people, in Turkestan region - 469 110 people, in Nur-Sultan - 165 151 people, and in Akmola region - 123 861 people, respectively *(IAC, 2019).*

3.3. TEACHER'S INFORMATION AND COMMUNICATION TECHNOLOGY COMPETENCIES

Teachers' information and communication technology (ICT) competences are a key variable to integrate such resources into the teaching-learning process *(Almerich, Orellana, Suárez & García, 2016)*. By using information resources teachers can easily provide educational materials and be more effective in everyday work. ICT competences are a key factor to enable teachers to change their practice and to implement these technologies in their educational practice *(Ertmer& Ottenbreit-Leftwich, 2010).*

UNESCO underlines three key ICT competencies from the pedagogical dimension containing the **design, implementation,** and **assessment of ICT-enabled educational spaces** *(UNESCO, 2016):*

- Competencies in the development of curricula using ICTs indicate pedagogical skills in organizing and planning elements, creating an effective ICT environment for high-quality and comprehensive student learning;
- The competencies for the implementation of ICT-oriented educational practices are associated with the skills to develop and create an educational environment, that will be reflected in the pedagogical practice of the teacher;
- Competencies for assessing the effectiveness of the educational environment using ICTs are related to skills that allow teachers to evaluate their educational effectiveness to further promotion of effective learning through the introduction of ICTs.

Thus, the use of ICT in the educational process in Kazakhstan, as a rule, involves retraining of the teaching staff for the development of their ICT competence, for the high-quality and effective use of ICT devices. Understanding the importance of increasing the technical competence of teachers, the state has identified indicators for measuring the level of ICT mastery, reducing the digital inequality among users. So, according to the state program adopted in 2005 for the development of education 90% of teachers (total number 338 755 people) should be trained for the use of ICT in the educational process by 2020. In 2007-2009 a program for these purposes for the development of computer literacy was also adopted and in this framework teaching computer literacy to teachers is actively conducted.

According to the reports, during the period from 2012 to 2014, as a part of the continuing education the course "ICT Competence of Teachers through the Introduction of E-learning System for Educational Organizations", 24 thousand teachers of the country increased their ICT competence. The largest number of teachers who improved ICT competency by regions of the country was noted in Almaty (2,654 people), Turkestan (2,604 people) and East Kazakhstan (2,540 people) regions. Teachers of secondary schools in the city of Nur-Sultan made up the smallest part of the participants in continuing education courses in ICT (722 people) *(IAC, 2020).*

In 2015 only 9% of teachers took training courses, and in 2018 another 15,050 or 4% of teachers were trained by means of e-learning *(Kazinform, 2018).* These figures are rather modest, since modern technologies are actively introduced in schools in Kazakhstan, it is important to conduct the retraining of teachers on time. In addition, existing studies show that student learning outcomes are more dependent on the quality of teaching rather than on the number of students in one class *(Rivkin, Hanushek and Kane, 2005).*

Thus, it can be assumed that the implementation of educational

informatization projects in Kazakhstan is still associated with a low level of computer literacy of teaching staff and this indicates the need for a high-quality study of the issues of education, training and advanced training of teaching staff. Teachers should take regular continuing education courses on an ongoing basis. In Kazakhstan, as a rule, compulsory teacher development courses are held every 5 years at the expense of state funding, and the heads of educational institutions must ensure that their teaching staff take necessary courses.

3.4. INFORMATION TECHNOLOGY IN EDUCATION PROCESS

With the transition to e-learning in the educational process of schools in Kazakhstan, new curricula began to be actively introduced. They are usually necessary for the development of ICT competencies among students. So, in the academic year 2017-2018, in 87 schools of Aktobe oblast and 57 schools in Astana (now Nur-Sultan), the program “Fundamentals of Programming” for 2-4 grades of primary education was introduced in a pilot mode *(IAC, 2019).* Moreover, this program is provided as an optional course and is aimed at the development of algorithmic and logical thinking, as well as at fostering interest in engineering sciences.

From the 2018-2019 academic year, the subject “Information and Communication Technologies” for grades 1-4 was also introduced in elementary schools, and the period for studying the subject “Informatics” was increased in high schools and the content of curricula for this subject was improved *(Turantimes, 2019).* However, even though the school curriculum contains the subject “Computer Science” (in the section “Natural Sciences”), the number of hours given does not allow the students to study this area more deeply. In addition, the training program is being updated quite slowly, and information and communication technologies in the world are developing extremely fast. For example, the subject "Computer Science" in high school (grades 9-11) is only 1 hour per week *(IAC, 2018).* The same situation and load in secondary and primary schools.

At the same time, taking into account the importance of information technology in the world, robotics classrooms continue to open in schools in Kazakhstan, where modern programming languages in the field of robotics, 3D modeling and machine learning systems are developing. The number of robotics classrooms in the 2018-2019 academic year reached 1,380 units (2017 - 1,172). The largest number of such offices operates in East Kazakhstan (283 units), Pavlodar (152), Zhambyl (151), Karaganda (150), Turkestan (114) and Akmola (108 units) regions. Robotics study groups work in 2,000 schools, 3,500 - the introduction of an elective robotics course was developed by NIS *(IAC, 2020).*

From the 2018-2019 academic year, all new school textbooks published in Kazakhstan have an electronic format. However, according to the opinion of scientists, in the context of the use of ICTs and e-learning in schools in Kazakhstan, several significant problems remain unresolved. The methodology for e-learning is not unified, ICTs and e-learning are positioned as web-based learning, and the broadband Internet is not able to reproduce the available multimedia material that is necessary for a full-fledged educational process of schools. In addition, ICTs and e-textbooks are given a secondary role as an advanced technical tool *(Esengabylov, Aldarbergenova, Zhiembayev, 2015).* The reality is that 71% or 5285 schools in Kazakhstan are in rural areas, 54% or 2850 of them are small schools *(IAC, 2020).* In this regard, it is difficult to confirm about the full implementation of ICT and e-learning in Kazakhstan. The Ministry of Education and Science of the country also confirms that the current Internet in Kazakhstani schools is not adapted for e-learning. *(Smolin, 2020).*

3.5. EXTERNAL ASSESSMENT OF ACADEMIC ACHIEVEMENTS BY ICT

Measures on informatization of education allowed to develop a unified information system for assessment students’ learning outcomes. Currently the country has information systems for a unified national testing (UNT), complex testing, and an external assessment of academic achievements. These systems not only improve the quality of assessment of educational results, but also give the prospective student the right to choose a specialty, a university, where training is being conducted in accord to the chosen specialty.

Table 1. Data about the average score of UNT

Region	2014	2015	2016	2017	2018
Almaty city	93.4	91.8	96.0	95.9	101.1
Pavlodar	79.9	80.2	88.2	91.9	91.0
Zhambyl	72.3	78.6	78.3	78.0	89.4
Kostanai	79.9	78.8	83.0	81.9	86.7
Kyzylorda	74.2	81.7	82.6	82.4	86.1
Aktubinsk	84.0	82.7	82.8	82.4	85.6
East-Kazakhstan	78.0	80.2	83.3	82.3	82.3
West-Kazakhstan	81.3	83.6	82.1	80.3	81.9
Almaty	72.6	76.4	79.6	77.5	81.0
Nursultan city	87.6	86.7	89.2	85.0	79.9
Akmola	80.2	78.2	77.7	80.0	79.0
Mangistau	74.5	75.8	78.5	77.7	78.8
Karaganda	76.9	79.6	81.8	78.3	77.9
Turkestan	74.5	78.7	77.7	77.0	77.8
North-Kazakhstan	77.9	77.8	78.8	75.1	77.6
Atyrau	62.1	61.0	70.0	72.2	73.8

Source: data of NEBD (National Educational Data Base)

If there is an attempt to correlate the results of UNT with the level of computerization and Internet access in the regions of the country (Table 1), assuming that their availability allows prepare for UNT better, then in five leading regions the rating in accord to the average UNT score, the ratio of students per one computer is: 15 people in Almaty, 5 people in the Pavlodar region, 9 people in the Zhambyl region, 8 people in the Kostanay region, and 11 people in the Kyzylorda region. In fact, the three regions that are at the end of this table are the following regions: 16 people per computer in Turkestan, 5 people in North Kazakhstan and 12 people in Atyrau region.

Table 2. Information on the informatization of daytime public comprehensive schools (2018-2019 academic year)

Region	Number of schools	Total number of computer devices in schools used in the learning process	Number of decommissioned computers	ratio of students to computers	Number of interactive boards, units	Total number of lingua-phone rooms and multimedia laboratories	Number of schools with internet access	Number of schools among them connected to broadband Internet speed higher than 512 kbit/s	Number of schools among them connected to the Internet with the speed higher than 4 Mbit/s
RK	**7334**	**308 293**	**66 543**	**11**	**38 691**	**3 303**	**6 944**	**6 901**	**6 606**
Akmola	576	13 310	3 158	9	1 696	244	555	555	555
Aktubinsk	412	18 493	2 599	8	2 067	132	401	397	394
Almaty	781	38 211	6 011	11	3 258	374	760	757	705
Atyrau	202	11 031	3 207	12	1 977	125	191	191	183
West-Kazakhstan	390	12 397	4 304	9	2 550	93	359	349	330
Zhambyl	459	26 458	1 061	9	2 481	204	442	442	442
Karaganda	539	24 398	4 702	8	2 787	181	504	502	498
Kostanai	522	14 203	5 675	8	1 791	178	498	496	457
Kyzylorda	307	14 285	4 367	11	2 294	66	293	293	293
Mangistau	159	9 027	1 704	16	1 338	79	138	138	138
Pavlodar	371	21 033	323	5	1 758	135	356	356	356
North-Kazakhstan	496	13 613	2 806	5	1 435	202	475	470	433
Turkestan	919	29 304	13 363	16	2 927	475	896	881	753
East-Kazakhstan	687	27 234	5 230	7	3 356	357	648	648	648

Nur-Sultan city	105	8 584	1 578	20	1 865	31	87	86	86
Almaty city	271	17 832	3 126	15	4 417	291	205	205	205
Shymkent	151	8 880	3 329	23	694	136	136	135	130

Source: data of NEBD (National Educational Data Base)

The table with the above-mentioned information does not demonstrate the relationship between computer equipment and the Internet in schools. Some researches indicate that a high level of information technology equipment does not always positively affect the educational results of students *(Caglar&Aksin, 2016).* However, some researchers still point out that school infrastructure, including the number of computers in a school has an impact on students' performance *(Sangrà & González-Sanmamed, 2010).*

If there is an attempt to correlate the results of UNT with the level of computerization and Internet access in the regions of the country (Table 1), assuming that their availability allows prepare for UNT better, then in five leading regions the rating in accord to the average UNT score, the ratio of students per one computer is: 15 people in Almaty, 5 people in the Pavlodar region, 9 people in the Zhambyl region, 8 people in the Kostanay region, and 11 people in the Kyzylorda region. In fact, the three regions that are at the end of this table are the following regions: 16 people per computer in Turkestan, 5 people in North Kazakhstan and 12 people in Atyrau region.

It should be noted here that according to the State Education Development Program for 2011-2020, Kazakhstan intended to reduce the number of students per computer to one person by 2020 *(MES RK, 2010).* This indicator of the state program will likely not be achieved at the indicated time, since in 2019 there are still 11 people per 1 computer (Table 2). In 2015, OECD experts warned Kazakhstan that some indicators of the state education development program might not be achieved by 2020 *(OECD, 2015).*

Meanwhile, for a better understanding of the association between the level of informatization of schools and the average score of the UNT, we decided to look at the availability of access to the Internet, including broadband Internet, in schools. So, if we look at the data on schools in the same leading 5 regions in terms of the average UNT score (the cities of Almaty and Pavlodar, as well as Zhambyl, Kostanay and Kyzylorda regions), we can find out that the number of schools with Internet access in these regions is not so high compared to other regions. For example, in the city of Almaty the number of such schools is only 205, in Pavlodar - 356, and in the Kyzylorda region - 293 schools. At the same time, the data in Table 2 show that Turkestan, Karaganda, North Kazakhstan regions are among the leading regions in terms of the level of broadband Internet connection, however, the average UNT scores of these regions are significantly inferior to those of the previously indicated regions.

If, as such, there is no serious correlation between the average UNT score and the level of equipment of schools with computers and the Internet, then, in our opinion, attention should be paid to the level of income in the context of regions. Today, it is widely believed among scientists that the socioeconomic status of families affects the level of academic success of students *(Li and Qiu, 2018; Gobena, 2018).*

Table 3. Dynamics of population incomes by regions of Kazakhstan for the 2nd quarter of 2020 (thousand tenge)

Region	Q2 2020	Increase in% compared to Q2 2019
Akmola	186,0	+ 16,1
Aktubinsk	176,8	+ 1,4
Almaty	164,1	+ 12,4
Atyrau	**169,2**	**+ 10,1**
West-Kazakhstan	184,1	+ 14
Zhambyl	140,7	+ 9,8
Karaganda	216,5	+ 8,4
Kostanai	202,9	+ 11,5
Kyzylorda	157,2	+ 14,2
Mangistau	211,8	+ 6,8

Pavlodar	**192,2**	**+ 8,8**
North-Kazakhstan	200,5	+ 10,7
Turkestan	**113,3**	**+ 12,8**
East-Kazakhstan	210,9	+ 10
Nursultan city	241,3	+ 6,4
Almaty city	**224,3**	**-4,5**
Shymkent city	148,3	+2,2

Source: WORKFORCE DEVELOPMENT CENTER, 2020

As the data in Table 3 show, the city of Almaty with an average UNT score of 101 points is in the top 3 regions with the highest income level of the population (224, 3 thousand tenge), while the Turkestan region closes the number of regions with the lowest income level of the population (113 thousand tenge), and is also among the 3 regions with the lowest average UNT score (77.8 points). At the same time, the Atyrau region, which is inferior to the Pavlodar region in terms of the average UNT score (73.8 and 91 points, respectively), is also inferior to this region in terms of the income of the population (169.2 thousand tenge and 192.2 thousand tenge, respectively). Thus, the given data show a certain correlation between the income levels of the regions and the average UNT score. It is assumed that families with a high level of income can allow their children additional classes and circles, the purchase of the necessary educational equipment, etc.

At the same time, the authors assume that a comparative analysis of data on the level of ICT competence of Kazakhstani teachers could also help to understand the effect of informatization of education on the academic achievements of students. However, the available information on the level of ICT competence of teachers in Kazakhstan is rather old and is presented only for the period 2012-2014. In this regard, these data will not fully reflect the effectiveness of the measures taken to informatization at the level of education of young Kazakhstanis. For example, in terms of the level of retraining of teachers in ICT technologies, according to the Information and Analytical Center under the Ministry of Education and Science of the Republic of Kazakhstan, Turkestan, East Kazakhstan and Almaty regions were among the leaders, and the city of Nur-Sultan retrained the smallest number of teachers. However, all these regions are inferior in terms of the average UNT score to other regions of the Republic of Kazakhstan. Thus, the level of ICT competence of teachers does not quite sufficiently influence the academic performance of students.

DIGITAL AND IT - EDUCATION IN KAZAKHSTAN

In the framework of the state program “Digital Kazakhstan”, in the field of higher and postgraduate education, a Road Map for the development of human capital for the digital economy for 2018-2020 has been approved. In this regard, almost the entire system of higher education, as well as the range of educational programs, is being reviewed to introduce the digital technologies into the educational process. The state educational order is formed for three years, considering the forecasted needs of the labor market for highly qualified personnel. The volume of government orders for those specialties that are mostly in demand for the digital economy has been increased. Since 2018, more than 10 thousand state grants will be given annually for IT specialties. Personnel training is conducted in 83 universities with a contingent of students of 12,992 people, where 800 grants were provided for retraining the teachers in ICT technologies in 2018 *(Forbes, 2018).*

The classifier of training areas with higher and postgraduate education also under consideration of educational programs that meet the challenges of the digital economy and the demands of the labor market. In 2018, more than 40 new experimental educational programs were approved that were introduced in 8 higher educational institutions *(Turantimes, 2019).* Training the staff who have higher education degrees started under such new educational programs as: “Smart-technologies”, “Combating criminal offenses in the field of informatization”, “Computer Mechatronics”, “Digital Humanities”, “Informatics and Robotics”, “Digital history”, “Designer of Virtual Worlds”, “IT-management”,“IT-audit ”,“Special Tools and Telecommunication Technologies”, “Digital Media Management”, “Computer Science and Technology”, “Digital Technologies in Agro-industrial

Complexes", "Big Data Analysis", "Cyber Security", "IT and Journalism", "Digital Media Technologies", "Data Analysis", etc. *(Forbes, 2018).*

Moreover, training in a few specialties, such as "Cyber Security", "IT Management and some others, is carried out not only in Kazakhstan, but also in foreign universities as part of the Bolashak presidential scholarship program. Since 2014, the Bolashak program has been actively training personnel for IT specialties within the framework of a special quota. Today, about 1,500 Bolashak residents completed training in technical and IT specialties.

Relevant IT platforms, business incubators and innovation centers are being created at the universities in the country to develop students' IT competencies, and on the base of this ecosystem the training seminars, hackathons, project competitions, and student entrepreneurship development will be conducted. Student training laboratories in robotics, computational linguistics and artificial intelligence are opening.

Universities of the country also pay attention to the development of massive open online courses (MOOCs), expanding access to popular educational programs. Currently, a consortium for the promotion of MOOCs has been created based on the type of international educational platform such as Edx, Coursera, FutureLearn on the base of Al-Farabi Kazakh National University with the participation of 15 Kazakhstani universities. This Consortium provides more than two thousand online courses with the participation of 146 partners from 28 countries *(Forbes, 2018).*

Meanwhile, the results of a study conducted by the All-Russian Center for the Study of Public Opinion in cooperation with SAP, which was attended by about 1,400 Kazakhstani students, showed that the curriculum for IT specialties in Kazakhstan does not meet the requirements of the modern IT market. The choice of profession has little to do with the desire to work in the IT field, it so more connected with the lack of competition among IT specialists. In addition, the students do not see serious career prospects in the IT field and do not know what the employer really wants *(Forbes, 2015).*

This information is also confirmed by the rating of 66 educational programs in IT specialties that were created in 2018 by the Atameken National Chamber of Entrepreneurs. So, according to the data of the above-mentioned rating, in the educational programs of IT specialties, there were subjects that were not necessary for study, furthermore, obsolete programming languages were used, the programs do not meet the needs of the IT market. The lack of necessary laboratory rooms and computer programs did not allow students to learn modern programming languages *(Atameken, 2018).*

4. DISCUSSION and CONCLUSION

The results of this study show that Kazakhstan is taking measures to informatize the system of education by equipping schools with computer equipment, language-multimedia equipment, and broadband Internet and etc. Steps are being taken to increase the competence of teachers for the use of ICT in the educational process. However, taking into consideration that the informatization of the secondary education started in 1997, the steps that were taken by the state are still characterized by a lack of consistency. For example, the tasks that were set to bring the number of teaching staff who had retraining for the use of ICT in the educational process to 90% by 2020 but this level remains at the level of 20-25%. Provision the schools with technical equipment is marked by a regional disbalance. There are regions that pay a serious attention to equipping schools with modern equipment, which should subsequently affect the quality of students' learning outcomes. At the same time, there are regions that do not pay due attention to this issue. Concerning this, the state's ambitious plan to bring the average number of students per computer has the ratio 11: 1 in 2019, and the state educational development program set the goal of bringing this indicator to - 1 student: 1 computer.

The analysis also shows that providing the schools with computer equipment and other interactive technology does not affect the quality of education in schools. In addition, the average score of a Unified National Testing in the regions of the country does not show the correlation of

the ratio between the number of students to one computer and the level of students' UNT score. The average number of students per computer is relatively the same in regions with a high average UNT score and a low UNT score. Such a difference may occur depending on the level of quality of teaching, qualifications of teachers, the academic students' zeal, and family income. Moreover, according to the studies, computer and multimedia technologies in schools are mostly used as material for the educational process, and the level of the Internet will not allow to use the available multimedia and online material for school programs. And in general, the Internet in the country is not adapted for the use of e-learning in schools. This fact has been also confirmed by the Ministry of Education and Science of Kazakhstan *(Smolin, 2020).* Moreover, if we take into account that in preparation for school assignments, schoolchildren can use the mobile Internet, then in 2020 the download speed of data on the mobile Internet in Kazakhstan did not reach 19 Mbit/s, while on average in the world it is about 32 Mbps. In terms of mobile Internet speed, Kazakhstan is inferior to Armenia and Russia, but ahead of Belarus and Kyrgyzstan, ranking 103rd out of 140 countries in the world. At the same time, the number of cellular subscribers with Internet access in the country reaches 15 million *(Businessmir.kz, 2020).*

In the system of higher education, despite the attempts made by the universities to provide a range of programs in accordance with the market needs, the content of educational programs is still not updated in accord to the market and technological pace. The lack of prestige of IT specialties, to a certain extent, affects the level of motivation of students. The data also indicate that the ICT competencies of teachers may not fully meet the expectations of students, since universities still do not pay enough attention for retraining and professional development of teachers to implement the digital approaches in the learning process.

Kazakhstan needs a more systematic approach to the implementation of the tasks of informatization of the educational system, and timely measurements of achievement of the indicated indicators and find out the reason for their failure. It should be recalled that Kazakhstan has not achieved its goal of bringing the average number of students per computer in the country's schools to 1: 1 by 2020 *(MES RK, 2010)*. As can be seen from the data presented, this ratio remains at the level of 10 students per computer *(NEBD, 2019).*

In conclusion, the peculiarity of this research is that it collects the latest data in the field of informatization the education and presents a consistent analysis of the development of ICT education in Kazakhstan. In this work the data used of the competent authority in the sphere of education, and reviews of international experts. At the same time, one of the main limitations of this paper is that in some aspects of the analysis there is a lack of detailed study due to the absence of available materials both in the reports of the Ministry of Education and Science and in other official publications.

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ҚАЗАҚСТАННЫҢ БІЛІМ БЕРУ ЖҮЙЕСІНЕ АҚПАРАТ ЖӘНЕ БАЙЛАНЫС ТЕХНОЛОГИЯЛАРЫН ЕНГІЗУ: ҚИЫНДЫҚТАР МЕН МҮМКІНДІКТЕР

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ВНЕДРЕНИЕ ИНФОРМАЦИОННЫХ И КОММУНИКАЦИОННЫХ ТЕХНОЛОГИЙ В СИСТЕМУ ОБРАЗОВАНИЯ КАЗАХСТАНА: ВЫЗОВЫ И ВОЗМОЖНОСТИ

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