

NORTHERN AND ARCTIC SOCIETIES

UDC: [332.1:004](985)(045)

DOI: 10.37482/issn2221-2698.2021.43.144

Digitalization in Education and Distance Barriers in the Russian Arctic: Problems and Prospects *

© Natalya V. DYADIK, Ph.D. of Economic Sciences, Senior Researcher

E-mail: ndyadik@mail.ru

Luzin Institute for Economic Studies — Subdivision of the Federal Research Centre "Kola Science Centre of the Russian Academy of Sciences" (IES KSC RAS), Apatity, Russia

© Anastasiya N. CHAPARGINA, Ph.D. of Economic Sciences, Senior Researcher

E-mail: achapargina@yandex.ru

Luzin Institute for Economic Studies — Subdivision of the Federal Research Centre "Kola Science Centre of the Russian Academy of Sciences" (IES KSC RAS), Apatity, Russia

Abstract. In the era of digital technologies, the issues of providing highly qualified personnel, the effective use of the intellectual potential of the territory and the creation of conditions for its reproduction are of particular importance. These problems are more acute in remote areas of the Russian Arctic. This is due, firstly, to the ultradispersity of the settlement system in the Arctic of the Russian Federation, and, secondly, to the imbalance between the demand and supply of labor resources in territorial and professional terms. Digitalization has become an integral component of education all over the world; therefore, the purpose of this article is to assess the availability of education in the regions of the Russian Arctic and to search for new targets for quality education in the context of digital transformation. The existing educational environment in the Arctic regions is analyzed in the article. The impact of urbanization degree on affordable education in remote Arctic regions is assessed. The financial capabilities of the population are investigated. Based on the analysis, a number of problems associated with the active dissemination of new technologies are identified. Recommendations for improving the educational process are given, taking into account the digitalization of society. The main stages of modernization of the educational process in remote regions of the Arctic are identified.

Keywords: *Arctic region, education, digitalization, territorial remoteness, access to education.*

The problem of formation and development of human potential of the territory are of great interest for both society and the state. In the age of digitalization and informatization of society, the issues of providing highly qualified personnel, effective use of the territory's intellectual potential and creation of conditions for its reproduction are of particular relevance. These problems are especially acute in small and medium-sized cities in the Russian Arctic. This is primarily due to the specifics of their economic and geographical position in relation to the nearest large urban agglomerations, where the main educational institutions are concentrated. The rapidly developing market of digital technologies creates new challenges for educational institutions; therefore, initiative and ability to think creatively, to find non-standard solutions and to choose a professional path become the most important qualities of a person. At the same time, state policy should be aimed at raising the educational level of the population and increasing human potential as a whole.

* For citation:

Dyadik N.V., Chapargina A.N. Digitalization in Education and Distance Barriers in the Russian Arctic: Problems and Prospects. *Arktika i Sever* [Arctic and North], 2021, no. 43, pp. 144–160. DOI: 10.37482/issn2221-2698.2021.43.144

The development of human potential was first considered in the works of A. Smith, W. Petty, D. Ricardo and K. Marx, and the concept has changed in the course of scientific development. Thus, D. Ricardo, J. Mill gave education, acquired abilities and upbringing the most important role in the formation of human potential capable of generating income in the future [1, Sakharovsky S.N.]. The idea of human capital was further developed in the works of T. Schultz, G. Becker, W. Bowen, proving that the qualitative characteristics of the labor force in the economic development of society are of paramount importance [2, Sokolova D.V., Kulakova A.B.]. Today H. Lipovska, I. Odoardi, F. Muratore are studying the influence of the educational process on the formation of human capital [3, Lipovska J., Fischer J., 4, Odoardi I., Muratore F.]. Modern Russian economists have also made a significant contribution to the development of the theoretical foundations of the concept of human potential. N. Dneprovskaya believes that the state policy of recent years is aimed mainly at creating the IT infrastructure of higher education [5, Dneprovskaya N.V.]. Whereas, Mavlyutova G.A. thinks that it is necessary not only to re-equip IT resources in education, but also to talk about the need for a kind of reloading of human potential [6, Mavlyutova G.A.]. A. Marey's view on the issue of digitalization is interesting. She defines it as a change in the paradigm of communication and interaction with each other and society¹, and L. Shmelkova emphasizes that the most important feature of a person adequate to the digital economy is that this person owns digital technologies, applies them in professional activity [7, Nikulina T.V.].

Thus, the abundance of scientific works allows us to conclude that the development of digital technologies affects the formation of human capital, but the issue of inequality in education remains aside, namely, the implementation of the opportunities provided by society and the state in different regions. Therefore, the purpose of this study is to assess the availability of education in the regions of the Russian Arctic and to search for new targets for quality education in the context of digital transformation.

In order to achieve this goal, the following objectives are identified: to analyze the existing educational environment in the Russian Arctic; to assess the impact of the degree of urbanization on affordable education in remote regions; to explore the financial capabilities of the population in the context of the availability of educational services; to identify problems and prospects for the development of education in the Arctic, taking into account the digitalization of society.

The level of urbanisation as a factor of the education accessibility in the Arctic

The accessibility of education is influenced by many factors (economic, territorial, social, etc.). In the Arctic, the study of the territorial factor (place of residence, level of urbanization, the number of universities in a certain territory, etc.) acquires particular importance, since all its settlements are located in extreme natural and climatic conditions and have a territorial gap and remoteness from regional centers.

¹ Marey A. Tsifrovizatsiya kak izmenenie paradigm [Digitalization as a Paradigm Shift]. URL: <https://www.bcg.com/ru-ru/about/bcg-review/digitalization.aspx> (accessed 15 September 2020).

An important indicator of territorial inequality in education is the type and size of the settlement (Table 1). Most Arctic regions are characterized by the focality of settlements concentration [8, Korchak E.A.]

Table 1

Distribution of urban districts and municipal areas in the Arctic regions of the Russian Federation, 2019

Arctic Regions	The number of urban districts and municipal areas with a population:			
	> 150 thousand people	75–150 thousand people	10–75 thousand people	< 10 thousand people
Republic of Karelia	0	0	3	0
Komi Republic	0	1	0	0
Arkhangelsk Oblast (without NAO)	2	0	3	2
Nenets Autonomous Okrug	0	0	2	0
Murmansk Oblast	1	0	12	4
Yamalo-Nenets Autonomous Okrug	0	2	8	4
Krasnoyarsk Krai	1	0	2	0
The Republic of Sakha (Yakutia)	0	0	0	5
Chukotka Autonomous Okrug	0	0	1	7
Arctic zone of the Russian Federation	4	3	31	22

Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation²

The data in Table 1 show that in the Arctic zone of the Russian Federation, most urban districts and municipal districts belong to small and medium-sized cities and have a population of less than 75 thousand people, which corresponds to almost 90% of their number (on average in Russia, the number of medium and small cities makes up 26% of the total number [9, Sekushina I.A.]). Despite the small number of urban districts and municipal areas, an analysis of the ratio of urban and rural populations showed that the majority of the population of the Russian Arctic regions lives in cities (Fig. 1).

² Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 05 December 2020).

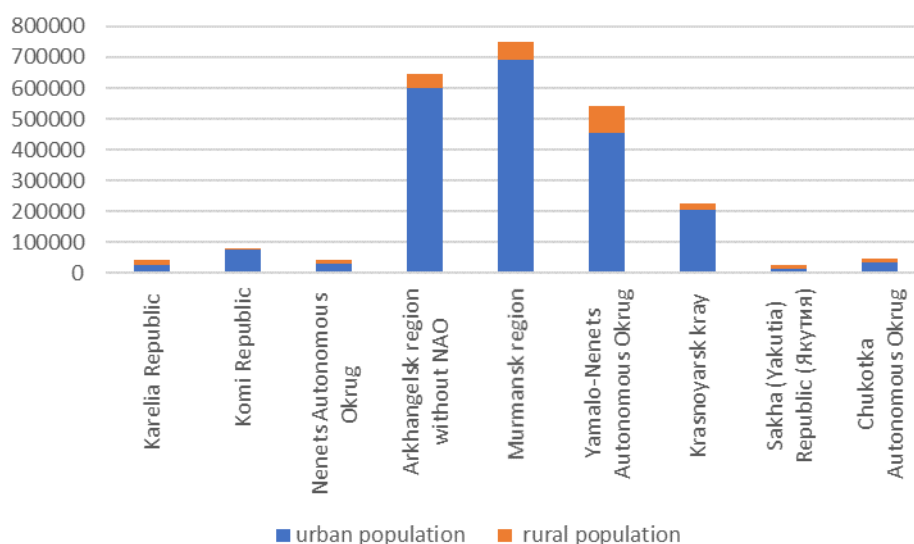


Fig. 1. The level of urbanisation in the Arctic regions of the Russian Federation, 2019 ³.

The most “strong” educational institutions are mainly located in regional (republican) centers. On the contrary, “ordinary” institutions are located mainly in villages, urban-type settlements and regional centers. In the Arctic conditions, in some territories there are no educational institutions at all (Republic of Karelia, Sakha (Yakutia), Nenets Autonomous Okrug). For example, in the Nenets Autonomous Okrug there is no one university at all. This region topped the list of regions with the least provision of local youth with educational places ⁴. In some municipalities of the Yamalo-Nenets Autonomous Okrug, there are almost 3500 tundra preschoolers and only about 10% of them receive preschool training ⁵; on the territory of the Gydan tundra of the Tazovskiy district, there are 213 children from the indigenous peoples of the North aged 0 to 7 years, 198 children of them [10, Novitskaya V.A., Yafizova R.I.] together with their parents lead a nomadic and semi-nomadic lifestyle, which significantly limits access and equal opportunities to receive education.

Despite the rather high proportion of the urban population, the Arctic regions are characterized by a low density and high ultradispersivity of its settlement (Table 2).

Table 2

Population size and density in the Arctic regions of the Russian Federation, 2019

Arctic Regions	Population size, thousand people	Population density, people / km ²
Republic of Karelia	616.1	0.99

³ Ibid.

⁴ Eksperty nazvali regiony Rossii s samym nedostupnym vysshim obrazovaniem, Yanvar' 2017 [Experts Named the Regions of Russia with the Most Inaccessible Higher Education. January, 2017]. URL: <https://www.rbc.ru/society/30/01/2017/588f0cab9a794716f7e77440> (accessed 15 December 2020).

⁵ Informatsionnyy portal «Go Arctic». Kochevoe obrazovanie [Information Portal "Go Arctic". Nomadic Education]. URL: <https://goarctic.ru/society/kochevoe-obrazovanie-cto-vy-khoteli-znat-no-boyalis-sprosit/> (accessed 15 December 2020).

Komi Republic	825.4	3.31
Arkhangelsk Oblast (without NAO)	1140.3	3.43
Nenets Autonomous Okrug	44.0	0.25
Murmansk Oblast	744.7	5.16
Yamalo-Nenets Autonomous Okrug	543.0	0.7
Krasnoyarsk Krai	2870.1	0.21
The Republic of Sakha (Yakutia)	969.5	0.06
Chukotka Autonomous Okrug	50.0	0.07
Arctic zone of the Russian Federation	7803.1	0.94

Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation⁶

The low settlement density in the Arctic regions increases the service radius and thereby makes various services, including educational ones, inaccessible for a part of the population.

Analysis of the educational environment of the Arctic regions

Currently, most of the Russian Arctic regions have all stages of education: primary, secondary and higher professional institutions (Table 3).

Table 3

Dynamics of the number of educational organizations⁷ in the Arctic regions of the Russian Federation in 2015–2019, %

Arctic Regions	2015/2016 academic year			2018/2019 academic year		
	General education	Secondary vocational education (including branches)	Higher education (including branches)	General education	Secondary vocational education (including branches)	Higher education (including branches)
Republic of Karelia	214	18 (0)	5 (3)	205	23 (5)	4 (2)
Komi Republic	359	23 (0)	9 (6)	336	31 (4)	6 (3)
Arkhangelsk Oblast (without NAO)	348	27 (1)	5 (3)	341	40 (1)	5 (3)
Nenets Autonomous Okrug	37	2 (0)	0	26	3 (0)	0
Murmansk Oblast	164	23 (5)	7 (5)	165	25 (6)	5 (3)
Yamalo-Nenets Autonomous Okrug	130	7 (1)	7 (7)	129	9 (2)	3 (3)
Krasnoyarsk Krai	1010	54 (8)	23 (14)	981	107 (35)	13 (6)
The Republic of Sakha (Yakutia)	628	37 (0)	15 (10)	636	57 (12)	9 (4)
Chukotka Autonomous Okrug	41	4 (0)	2 (2)	41	4 (0)	1 (1)

Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation⁸

⁶ Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 10 December 2020).

⁷ Private educational institutions were not counted.

Over the past five years, the number of state organizations providing the general education training program has decreased in almost all regions of the Russian Arctic, with the exception of the Murmansk region (the number of institutions increased by 1 unit) and the Chukotka Autonomous Okrug (no dynamics). The problems of developing small schools in hard-to-reach regions of the Arctic (Arctic uluses of the Republic of Sakha (Yakutia), settlements in the Nenets Autonomous Okrug and Yamalo-Nenets Autonomous Okrug) remain. For example, rural schools in the Republic of Sakha (Yakutia), which have a student enrollment of less than 100 students, are transferred from the status of a general secondary to basic schools, and some even to primary schools, and 53% of rural schools are small with an average enrollment of 50 to 120 students [11, Neustroev N.D., Neustroeva A.N.].

It should be noted that the number of higher educational institutions has also decreased significantly, mainly due to the reduction in the number of their branches. Currently, a serious problem for the Arctic regions is the growing shortage of labor resources, in particular, the issue of highly qualified specialists is acute. Therefore, against the background of the observed negative dynamics, there is a clear lag of the educational system from the needs of the market economy in these regions.

In the field of vocational education, on the contrary, there is a positive dynamics, which was especially manifested in the Krasnoyarsk region (from 54 to 107 institutions), the Republic of Sakha (Yakutia) (from 37 to 57 institutions) and the Arkhangelsk region (from 27 to 40 institutions). This growth is due, on the one hand, to the active development of the Arctic territories, on the other hand, to the preservation of the traditional way of life of the indigenous peoples of the North and the popularization of professions in demand in the Arctic (reindeer husbandry, fishing, sea animal hunting).

The next aspect that we would like to consider in the context of assessing the educational environment is the formation and development of automation of educational institutions in the Arctic regions.

According to the Rating⁹, reflecting the level of automation of educational activities in general education programs (excluding pre-school education), the Arctic regions (with the exception of the Krasnoyarsk region and the Republic of Karelia — no data available) can be divided into three groups¹⁰:

⁸ Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 15 November 2020).

⁹ The rating was developed by a group of experts for the analysis of Russian regional information systems in the field of general education, which shows the current level of automation of educational activities for general education programs in all constituent entities of the Russian Federation and determines the degree of compliance of regional UFTR systems (Unified Functional and Technical Requirements for Information Systems).

¹⁰ Rating of subjects of the Russian Federation by the level of automation of educational activities in general education programs (excluding preschool). Federal portal "Russian education". URL: <http://www.edu.ru/map/technology/> (accessed 20 December 2020).

Group 1 — regions with a low level of automation of educational activities (Arkhangelsk region and Chukotka Autonomous Okrug);

Group 2 — regions partially corresponding to the uniform functional technical requirements (UFTR) with the level of automation of educational activities (Murmansk region and Nenets Autonomous Okrug);

Group 3 — regions with a high level of automation of educational activities (the Republic of Sakha (Yakutia), the Yamalo-Nenets Autonomous Okrug and the Komi Republic).

Informatization and digitalization are taking place in different regions at different rates. In some regions, equipping with computers is just beginning, while some regions are already successfully functioning in a single information space (Fig. 2).

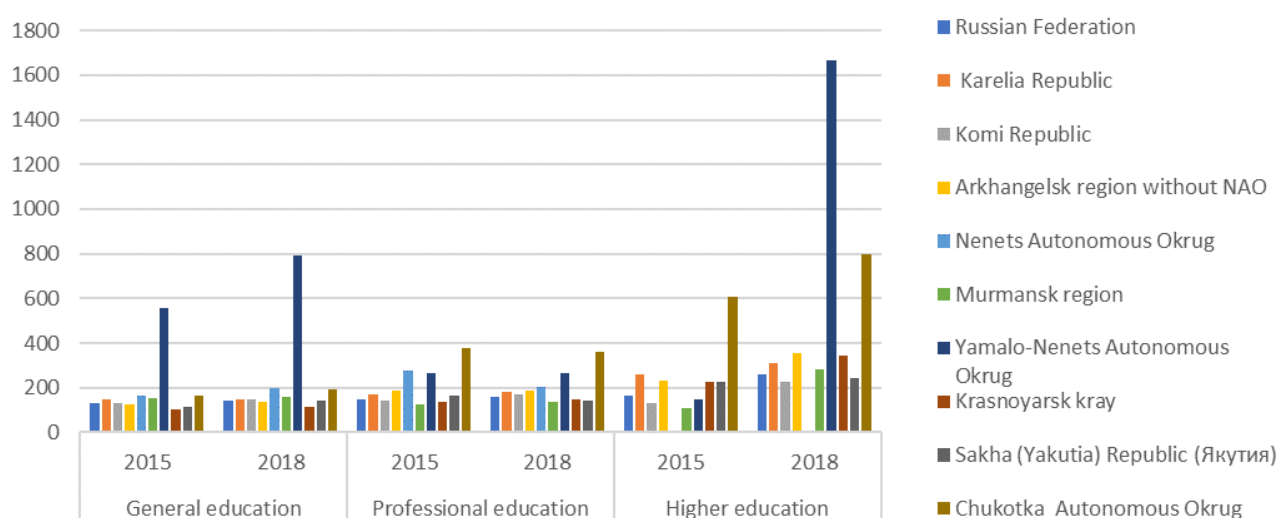


Fig. 2. Equipment of educational organizations with personal computers in the Russian Arctic regions, 2018¹¹. Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation¹²

The above data give grounds to assert that, firstly, the process of equipping the Arctic territories with resources is rather slow and uneven; secondly, the problem of informatization and automatization is most acute in remote Arctic regions. Nevertheless, the digital barrier¹³ among residents of the Arctic regions is gradually decreasing (Table 4).

¹¹ The number of personal computers per 1000 students.

¹² Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 01 February 2021).

¹³ Digital barrier — limiting the capabilities of a social group due to its lack of access to modern means of communication.

Table 4

The use of information technology and telecommunication networks in households in the Arctic regions of Russia in 2015 and 2019¹⁴

Arctic Regions	Number of households – total thousand units, 2019 (2015)	of which had (in % of the total number of households)			
		Personal Computer 2019 (2015)	Internet access 2019 (2015)	Internet access from a personal computer 2019 (2015)	Broadband Internet access 2019 (2015)
Republic of Karelia	270.8 (272.5)	71.3 (75.1)	77.7 (74.6)	68.4 (73.0)	77.3 (74.6)
Komi Republic	365.6 (367.2)	76.4 (84.8)	79 (83.2)	71.3 (80.0)	78.8 (82.0)
Arkhangelsk Oblast (without NAO)	485.4 (486.5)	74.6 (78.5)	77.5 (76.8)	70.4 (76.3)	74.0 (76.8)
Nenets Autonomous Okrug	15.6 (15.6)	75.7 (77.7)	74.8 (69.9)	67.8 (68.8)	67.5 (56.0)
Murmansk Oblast	340.5 (343.0)	79.1 (88.6)	84.2 (87.3)	77.5 (86.4)	83.6 (83.5)
Yamalo-Nenets Autonomous Okrug	186.5 (192.4)	92.4 (91.2)	95.0 (91.7)	90.2 (90.2)	93.9 (82.9)
Krasnoyarsk Krai	1 125.9 (1126.9)	63.0 (72.0)	69.5 (68.7)	60.1 (66.2)	66.4 (62.2)
The Republic of Sakha (Yakutia)	330.6 (330.6)	61.4 (70.2)	87.6 (75.5)	52.3 (56.9)	77.6 (55.0)
Chukotka Autonomous Okrug	21.7 (21.9)	92.0 (77.1)	93.4 (73.0)	91.2 (60.8)	50.6 (50.5)

In 2019, most households started using mobile phones or smartphones, mobile computers and e-book readers to access the Internet, as indicated by the declining share of households accessing the Internet from a personal computer, while the number of households with access to the Internet also increased. Also, from the authors' point of view, the decline in the number of personal computers indicates an increasingly widespread practice of replacing stationary personal computers with laptops. This is understandable from the financial standpoint: the purchase of mobile devices, as a rule, is cheaper than the purchase of a personal computer. But the unstable and sometimes incomplete “coverage” of the Arctic regions with mobile network leads to technical problems of using the Internet (connection quality, access in remote areas), which especially affects its use for educational purposes, where a continuous process of connecting to the resource is usually required.

It should be noted that, according to the authors, for the development of the educational environment in the Arctic regions (and not only in the Arctic), it is important to overcome not only the digital divide (the difference between participants in the educational process who have access to the Internet and digital devices at school and at home, and those who do not have Internet access), but also to level the so-called gap in digital use (the inequality between those who use digital technologies for educational and creative activities, and those who use them for everyday routine

¹⁴ Selective federal statistical observation on the use of information technologies and information and telecommunication networks by the population. URL: https://gks.ru/free_doc/new_site/business/it/fed_nabl-croc/index.html (accessed 01 February 2021).

activities — communication, sales/purchases, etc.). Perhaps, the transition of educational institutions to an alternative personalized educational process will help to reduce the gap in digital use.

Thus, the analysis showed that the educational environment of the Arctic regions is developing unevenly, in some regions the educational environment has a level of development comparable to the Russian average, in others, its development is severely delayed, including due to the low degree of digitalization and automation of educational processes.

Analysis of financial capabilities of the Russian Arctic population

Accessibility to educational services is determined not only by the territorial factor (geographic) and the availability of educational institutions, but also by the financial capabilities of the population. They can be assessed by various indicators, but the main and determining indicator is the level of the population's monetary income. Let us analyze the dynamics of the average per capita income of the population of the Arctic regions in recent years (Fig. 3).

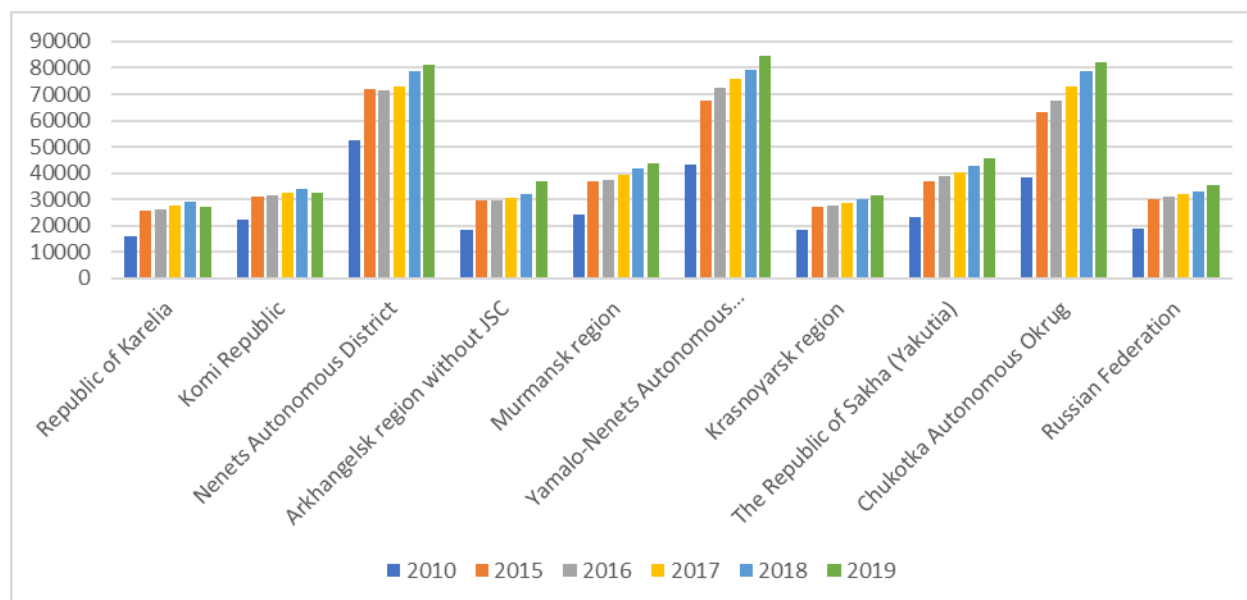


Fig. 3. Dynamics of the average per capita income of the Arctic population, rubles¹⁵.

In absolute terms, incomes of the population in the Arctic regions tend to grow and exceed the national average. A significant deviation in the level of income is observed in the Nenets, Chukotka and Yamalo-Nenets Autonomous Okrugs (more than 2 times from the average Russian level). At the same time, starting from 2013, the rate of income growth has slowed down both in Russia as a whole and in the Arctic regions. However, it is impossible to judge the satisfaction of the population with the level of their well-being and financial capabilities only by the trend of growth in the population's income in absolute and relative values.

In fact, the population assesses its standard of living not by the average rate of income growth, but by the growth in the ability to meet their needs at the expense of the income received. To a certain extent, the “purchasing power” of monetary incomes of the population of a particular

¹⁵ Regions of Russia. Socio-economic Indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 15 November 2020).

region can be determined by the ratio of monetary incomes to the regional subsistence minimum [12, Chapargina A.N.].

If we compare the incomes of the Arctic population with the level of the subsistence minimum, we will note that, despite their growth, the living standard of the Arctic population is approaching the standard of living of the average Russian (Fig. 4). It should be noted that during the period under study, the share of the subsistence minimum in the population's income is growing, which suggests a decrease in the standard of living, and accordingly, in their financial capabilities.

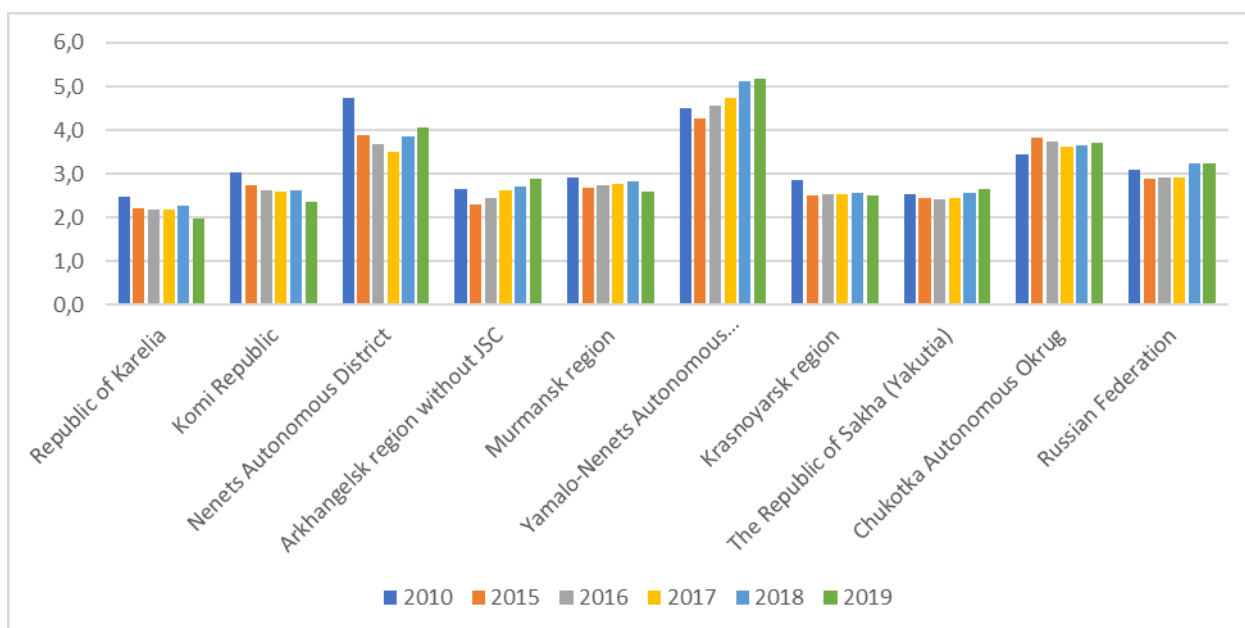


Fig. 4. Ratio of the subsistence minimum and population income in the Arctic regions of the Russian Federation. Source: authors' calculations based on the data of the Federal State Statistics Service of the Russian Federation¹⁶

The perception of the level and quality of life depends to a large extent not only on the social status of the person, but also on his expectations. The availability and quality of education is an element of human potential formation. Moreover, accessibility should mean the equality of educational opportunities: economic (financial) and transport (geographical) [13, Novikov A.M.]. The results of the above analysis proved that the regions of the Russian Arctic have an ultradispersed settlement, respectively, the population of these regions, in terms of geographical accessibility, cannot have equal educational opportunities. As for the financial affordability of education for the Arctic population, a comparison of the main income indicators with the national average showed, that the financial capabilities of the population living in extreme climatic conditions are rather weak (Figure 3, 4). The obtained correlation between the level of per capita income of the Arctic population and the volume of paid services in the regional education system, which is defined as strong (Table 5), seems interesting.

¹⁶

Regions of Russia. Socio-economic indicators. URL: http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics (accessed 15 November 2020).

Table 5

The volume of paid services to the population per capita in the education system (rubles) and the correlation between average per capita income and services

Arctic region	2010	2015	2016	2017	2018	2019	Correlation (income:services)
Republic of Karelia	2480.2	3338.4	3528.3	3564.9	3775.6	4181.3	0.89
Komi Republic	1863.9	3366.7	3403.1	3557.3	3759.9	3809.5	0.99
Nenets Autonomous Okrug	1045.8	2633.1	2598.5	2734.3	2737.3	2894.3	0.96
Arkhangelsk Oblast (without NAO)	1835.6	3917.9	3621.0	3394.9	722.5	3641.7	0.33
Murmansk Oblast	2932.6	3960.5	4147.5	4320.4	4669.6	5058.4	0.98
Yamalo-Nenets Autonomous Okrug	2375.6	2943.3	2885.0	3046.3	3146.7	3259.5	0.99
Krasnoyarsk Krai	1753.9	3417.7	3061.2	2887.3	3087.1	3249.4	0.89
The Republic of Sakha (Yakutia)	3016.1	5196.0	5562.1	5874.8	6761.6	6761.6	0.99
Chukotka Autonomous Okrug	673.8	3642.6	5461.6	5383.9	5694.7	5680.5	0.96
Russian Federation	228.7	3687.8	3847.0	4176.5	4464.1	4747.5	0.996

In general, the correlation value by region is more than 0.9; it is insignificant only in the Arkhangelsk region, due to a sharp decline in paid educational services in 2018. The obtained result can be interpreted in two ways. On the one hand, the increase in paid services can be assessed as a positive dynamics of growth in the standard of living of the population, since educational services are becoming more accessible. On the other hand, this trend can lead to an increase in income inequality and, as a consequence, reduce the availability of educational services.

Challenges and prospects of digitalization of education

The development of information technology transfers the educational process to a completely new level of development, and digital literacy is becoming an increasingly important component of success for the education and development of children. However, despite the active introduction of digitalization in all spheres of human life, including education, a number of problems associated with the progressive spread of new technologies should be noted.

The first problem is that society still has a digital divide in the use of technology, both at the level of Internet access (wealthier people have better digital access [14, Ma J.KH., Vachon T.E., Cheng S.]) and special skills for the application of information innovations. For example, in Russia, online education in schools is 0.1% versus 3% abroad¹⁷. The problem of using online platforms for distance learning in Russian schools¹⁸ (especially in some Arctic regions, where the Internet is still lacking¹⁹) in the context of the COVID-19 pandemic was especially evident.

¹⁷ Issledovanie rossiyskogo rynka onlayn-obrazovaniya i obrazovatel'nykh tekhnologiy [Research of the Russian Market of Online Education and Educational Technologies]. URL: <http://files.runet-id.com/2017/rif/presentations/19apr.rif17-2.3--dreval.pdf> (accessed 17 October 2020).

¹⁸ URL: <https://rg.ru/2020/07/14/tolko-25-procentov-shkol-okazalis-gotovy-k-distancionnomu-obucheniiu.html>

¹⁹ Severnaya shkola. Problemy i resheniya v sfere obrazovaniya v Arktike [Northern school. Challenges and Solutions for Education in the Arctic]. URL: https://aif.ru/society/education/severnaya_shkola_problemy_i_resheniya_v_sfere_obrazovaniya_v_arktike (accessed 17 October 2020).

The second problem is related to socio-economic inequality in digital educational use. It should be noted that such inequality exists even after achieving equality in digital access, and it remains a problem for both high-income and low-income countries [15, Hilbert M.]. In general, children with a higher socio-economic status are more likely to use computers for educational purposes²⁰, and vice versa, students with a lower socio-economic status are more likely to use digital devices for social networking and gaming and are therefore less prepared for academic tasks [16, Van Deursen A., Van Dijk J.].

The third problem is a rather low level of digitalization in the educational process due to territorial remoteness. The significance of the territorial barrier is due to territorial mobility. The most accessible quality education is for those who are not “tied to a place” and are ready (and can afford) to “travel for quality” of educational services. Territorial mobility is important both at the stage of obtaining general education and at the stage of obtaining higher education.

The identified problems are typical for Russia as a whole, and the specific features of the Arctic regions development, including the harsh natural and climatic conditions, the discomfort of living, the focus of settlement, the uneven development of the social and transport infrastructure, exacerbate them even further.

In the current pandemic situation, the urgent digital transformation in all spheres of society has necessitated the introduction of new targets in the educational process as well. This is caused, first of all, by the presence of problem areas in the educational environment: insufficiently developed infrastructure of data transmission channels in schools, unpreparedness of teachers to work in an online format and a lack of high-quality online resources. It should be noted that education is not designated as a priority industry for digital transformation in all Arctic regions, with the exception of the republics of Karelia and Komi, Yamalo-Nenets Autonomous Okrug (Table 6). Most of the regional projects in the field of the digital economy in the Russian Arctic are implemented in the areas of “information infrastructure and security” and “digital public administration”.

Table 6

Regional projects and priority areas of digitalization in the Arctic regions of the Russian Federation

Arctic regions ²¹	Regional projects in the field of “Digital Economy”	Priority areas of digitalization
Republic of Karelia	Creation of data transmission infrastructure for public authorities and households Creation of data transmission infrastructure for medical and educational organizations Development of communication networks at transport infrastructure facilities Introduction of digital technologies in the areas of public administration, business and society	Transport Building Housing and communal services Urban environment Agriculture
Komi Republic	Information infrastructure and security Digital government Digital technologies, smart city	Transport, housing and communal services Urban environment Health care

²⁰ ITU (2011). Measuring the information society. Geneva: ITU. URL: <http://www.itu.int/en/ITU-D/Statistics/Pages/publications/mis2011.aspx>. (accessed 11 December 2020).

²¹ No data available for Krasnoyarsk Krai.

Arkhangelsk Oblast (without NAO)	Human resources for the digital economy Information infrastructure and security Digital government	Public services and management Culture and tourism Transport, housing and communal services Urban environment Health care Personnel and education Financial and economic activities
Nenets Autonomous Okrug	Normative regulation of the digital environment Information infrastructure and security Digital government	Education Health care Transport, housing and communal services, energy
Murmansk Oblast	Information infrastructure and security Digital government	Industry Health care Housing and communal services, Urban environment Education
Yamalo-Nenets Autonomous Okrug	Information infrastructure and security Digital government Human resources for the digital economy	Transport, housing and communal services Building Urban environment Health care
The Republic of Sakha (Yakutia)	Information infrastructure and security Digital technologies Digital government	Industry Computer software development Urban environment Health care Personnel and education
Chukotka Autonomous Okrug	Information infrastructure and security Digital government	Health care Personnel and education Urban environment, housing and communal services Energy

Source: compiled by the authors based on data from the Analytical Center for the Government of the Russian Federation²²

For the further development of the educational sphere, as well as the widespread implementation of digital technologies in educational process in the Arctic, in our opinion, it is necessary to pay attention to the following activities:

- to form a legislative framework on the digitalization of education. Regional programs for the development of the digital economy have been developed and approved in the republics of Karelia and Sakha (Yakutia), as well as in the Chukotka Autonomous Okrug. The other regions of the Russian Arctic do not have such programmes;
- to modernize the forms of knowledge transfer and transmission in the educational process, primarily with the use of digital technologies;
- to develop remote education channels to remove territorial barriers, for example, in the Yamalo-Nenets Autonomous Okrug, there is an experimental educational project “No-

²² Tekushchee razvitie proektov v sfere tsifrovoy ekonomiki v regionakh Rossii, iyun' 2019 [Current Development of Projects in the Field of Digital Economy in the Regions of Russia. June 2019]. URL: <https://nangs.org/analytics/analiticheskij-tsentr-pri-pravitelstve-rf-tekushchee-razvitie-proektov-v-sfere-tsifrovoj-ekonomiki-v-regionakh-rossii-iyun-2019-pdf>

madic Schools”²³, which is focused, on the one hand, on the preservation of traditional forms of management, native language and national culture of the indigenous small-numbered peoples of the North, on the other hand, it is aimed at ensuring quality education in a modern northern school. Implementation of the project has already started in the Nadym, Priuralskiy, Purovskiy, Tazovskiy, Shuryshkarskiy and Yamal districts.

- to intensify interaction of authorities and companies in the raw materials sector within the framework of corporate social responsibility in order to attract investment in education and highly qualified personnel. For example, in the Murmansk region, a joint project of the Heads of municipalities of Apatity and Kirovsk with the FOSAGRO company — PhosAgro Schools has been implemented for five years in order to implement the educational paradigm School—College / University—Enterprise. The main task of this project is to train the engineering elite and ensure the inflow of highly educated personnel into the company;
- to create new forms of communication “region — municipal district — educational institution”, by means of creating regional centres providing continuous social and pedagogical support to children in the society and the region. A positive example is the implementation of a new regional project in the Yamal-Nenets AO “Yamal Schools — Wi-Fi Territory”, which is aimed at developing the information and technological educational environment of region’s schools and providing access to educational content of the global Internet²⁴.

Within the framework of the presented activities, the following stages of modernization of the educational process in remote regions of the Arctic can be distinguished:

Stage 1 — technical equipment of classrooms (high-speed Internet connection, computers, interactive whiteboards, etc.) within the framework of the national project “Education” and “Science and Universities”.

Stage 2 — training of the teaching staff in the context of digitalization (seminars, webinars, online courses, etc.).

Stage 3 — creation and development of educational portals that allow the educational institutions of the Arctic to be included in a unified information space of the educational environment.

Since digital technologies are likely to become the dominant force in society in the foreseeable future, the problem of the education availability in the specific conditions of the Arctic is gradually leveled out. Digitalization will expand the coverage of the population with educational services, since residents of the Arctic regions (including geographically remote ones) will be able to take an active part in online events that were previously not available to them.

²³ Informational portal. Yamal. Education. URL: https://edu.yanao.ru/pro/SitePages/kohev_school.aspx (accessed 02 February 2021)

²⁴ Informational portal. Yamal. Education. URL: <https://edu.yanao.ru/pro/SitePages/Wi-Fi.aspx> (accessed 02 February 2021).

Acknowledgments and funding

The article was prepared on the basis of research carried out within the framework of the research project 0226-2019-0023 “Scientific foundations for the formation and implementation of the financial and investment potential of the Northern and Arctic regions”.

References

1. Sakharovsky S.N. Institutional'nye faktory formirovaniya chelovecheskogo potentsiala [Institutional Factors of Human Potential Foundation]. *Zhurnal institutsional'nykh issledovaniy* [Journal of Institution Studies], 2012, no. 2, pp. 83–92.
2. Sokolova D.V., Kulakova A.B. Razvivayushchaya sreda obrazovatel'nogo uchrezhdeniya kak faktor formirovaniya chelovecheskogo potentsiala ekonomiki regiona [Developmental Environment of an Educational Institution as a Factor to Form Human Potential of Regional Economy]. *Voprosy territorial'nogo razvitiya* [Territorial Development Issues], 2015, no. 10 (30), pp. 1–13.
3. Lipovska J., Fischer J. Gifted Students and Human Capital Accumulation. *Journal on Efficiency and Responsibility in Education and Science*, 2016, vol. 9, no. 3, pp. 60–69. DOI: 10.7160/eriesj.2016.090302
4. Odoardi I., Muratore F. The Role of Human Capital after the Crisis in Italy: A Regional Analysis. *Socio-Economic Planning Sciences*, 2019, vol. 66, pp. 58–67. DOI: 10.1016/j.seps.2018.07.002
5. Dneprovskaya N.V. Otsenka gotovnosti rossiyskogo vysshego obrazovaniya k tsifrovoy ekonomike [Assessment of the Readiness of the Russian Higher Education for the Digital Economy]. *Statistika i ekonomika* [Statistics and Economics], 2018, vol. 15, no. 4, pp. 16–28. DOI: <http://dx.doi.org/10.21686/2500-3925-2018-4-16-28>
6. Mavlyutova G. A. Tsifrovizatsiya v sovremennom vysshem uchebnom zavedenii [Digitalization of Modern Institutions of Higher Education]. *Ekonomicheskaya bezopasnost' i kachestvo*, 2018, no. 3(32), pp. 5–7.
7. Nikulina T.V., Starichenko E.B. Informatizatsiya i tsifrovizatsiya obrazovaniya: ponyatiya, tekhnologii, upravlenie [Information and Digital Technologies in Education: Concepts, Technologies, Management]. *Pedagogicheskoe obrazovanie v Rossii* [Pedagogical Education in Russia], 2018, no. 8, pp. 107–113.
8. Korchak E.A. *Arkticheskaya zona Rossii: sotsial'nyy portret regionov* [Arctic Zone of Russia: Social Portrait of the Regions]. Apatity, Luzin Institute of Economic Studies of the KSC RAS Publ., 2017, 101 p. (In Russ.)
9. Sekushina I.A. Teoreticheskie podkhody k klassifikatsii malykh i srednikh gorodov Rossii [Theoretical Approaches to the Classification of Small and Medium-Sized Cities of Russia]. *Nauchnyy vestnik YuIM* [Scientific Bulletin of the Southern Institute of Management], 2019, no. 2, pp. 84–93.
10. Novitskaya V.A., Yafizova R.I. Model' kochevogo doshkol'nogo obrazovaniya na YaMAle: pervye itogi i novye strategii [Model of Nomadic Preschool Education in Yamal: First Results and New Strategies]. *Uchenye zapiski ZabGU. Ser.: Pedagogicheskie nauki* [Scholarly Notes of Transbaikalian State University. Ser.: Pedagogical Sciences], 2018, no. 3, pp. 13–23.
11. Neustroev N.D., Neustroeva A.N. Malokomplektnaya shkola Severa i Arktiki: problemy i perspektivy [Small Schools of the North and the Arctic: Problems and Prospects]. *Problemy sovremennogo pedagogicheskogo obrazovaniya*, 2019, no. 64(1), pp. 223–227.
12. Chapargina A.N. Ob investitsionnoy aktivnosti sberezheniy naseleniya v Arkticheskikh regionakh [Investment Activity of Population Savings in the Arctic Regions]. *Sever i rynek: formirovanie ekonomicheskogo poryadka*, 2017, no. 3(54), pp. 29–37.
13. Novikov A.M. Otsenka dostupnosti obrazovaniya [Assessment of the Accessibility of Education]. *Otechestvennaya i Zarubezhnaya Pedagogika*, 2012, no. 2 (5), pp. 11–14.
14. Ma J.K.H., Vachon T.E., Cheng S. National Income, Political Freedom, and Investments in R&D and Education: A Comparative Analysis of the Second Digital Divide Among 15-Year-Old Students. *Social Indicators Research*, 2019, vol. 144, iss. 1, pp. 133–166. DOI.org/10.1007/s11205-018-2030-0

15. Hilbert M. When is Cheap, Cheap Enough to Bridge the Digital Divide? Modeling Income Related Structural Challenges of Technology Diffusion in Latin America. *World Development*, 2010, vol. 38(5), pp. 756–770.
16. Van Deursen A., Van Dijk J. The Digital Divide Shifts to Differences in Usage. *New Media and Society*, 2014, vol. 16(3), pp. 507–526.

Received on January 18, 2021