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Assessing the Impact of Factors on the Education Infrastructure in the Arctic Zone of the Northern Macroregion

Lyudmila V.
VORONINA
N. Laverov Federal Center for Integrated Arctic Research of the Ural Branch of the
Russian Academy of Sciences
Northern (Arctic) Federal University named after M.V. Lomonosov
Arkhangelsk, Russian Federation
e-mail: Ludmila.science@yandex.ru
ORCID: 0000-0003-3607-0687; ResearcherID: E-6721-2017

Aleksei V.
GRIGORISHCHIN
Northern (Arctic) Federal University named after M.V. Lomonosov
Arkhangelsk, Russian Federation
e-mail: a.grigorischin@narfu.ru
ORCID: 0000-0001-5087-7677; ResearcherID: N-3690-2018

Dilmurad B.
IAKHIAEV
Northern (Arctic) Federal University named after M.V. Lomonosov
Arkhangelsk, Russian Federation
e-mail: dilmurad-92@mail.ru
ORCID: 0000-0002-3650-3924; ResearcherID: O-2610-2018

Abstract. Given the orientation of Russia's state policy toward the development of its Arctic zone, one of the major directions of socio-economic development in these territories is to modernize educational facilities and form a system of qualified personnel. Having calculated the rate of changes in the indicators, we reveal negative trends in the development of school and vocational education infrastructure in the Arctic zone of the Northern microregion; this confirms the relevance of the study. The education infrastructure, regarding its components, is understood as a set of infrastructure facilities of preschool, school and vocational education, as well as their staffing with qualified specialists. The aim of the research is to identify and assess the impact of a set of factors on the change in the education infrastructure in the Arctic zone of the Northern macroregion. We study the object of research at the mesoregional taxonomic level of spatial-territorial Arctic systems in relation to specific local communities; this increases the objectivity of our findings. The geography of the study is based on an institutional approach and includes Arctic mesoregions of the Arkhangelsk Oblast, Nenets Autonomous Okrug and the Komi Republic, which together form the Arctic zone of the Northern macroregion. We put forward our own methodological approach to assessing the impact of factors on social infrastructure in the Arctic zone of the Northern microregion. The approach contains a system of indicators reflecting changes in the education infrastructure and economic, demographic, spatial-territorial and socio-labor factors affecting it over the past fourteen years. We use methods of comparative analysis, systematization and grouping, statistical and correlation-regression analysis. The results of the study allow us to conclude that the influence of the factors on the education infrastructure in the Arctic zone of the Northern macroregion is differentiated depending on the nature and pace of development of the territories under consideration, state policy implemented in these territories, and other factors.

Key words: Arctic, North, education infrastructure, factors, mesoregion, methodological approach.

Introduction

In the modern world, education is one of the basic parameters that affect the development of human potential. The quality of education has a direct impact on such important indicators as labor productivity, unemployment rate, wages and, ultimately, the quality of life. In order to achieve a high level of education in society, it is necessary not only for people to be willing to acquire knowledge and improve their skills, but to have high-quality the education infrastructure facilities as well. Special attention should be paid to the quality and accessibility of preschool and school education. It is at this level that the foundation is laid for the formation of human values, general education and upbringing. The quality of labor resources depends on the development of secondary and higher professional education.

The Constitution of the Russian Federation guarantees equal access of all citizens to educational services, and equal rights to education. In practice, the availability and quality of education often directly depend on the overall level of socio-economic and infrastructural development of the territory. Since the beginning of the 21st century, socio-economic development of the Arctic territories has been one of the priorities of state

policy. In order to reduce interregional differences in the standard of living and quality of life, the authorities have identified 12 new macroregions. The Northern macroregion is one of the newly created macroregions; all its constituent entities fully or partially belong to the Arctic zone of the Russian Federation. Thus, there is a strategic need for research in the Arctic territories of the Northern macroregion, which are characterized by low population density, poor economic and engineering development, insufficient transport connectivity of the territory, negative demographic trends. All this adversely affects the development of the education infrastructure, its quality and accessibility for residents of the Arctic.

To achieve the purpose of the study, a set of the following related tasks was addressed: clarifying the interpretation of the education infrastructure as an object of management in the regional economy; determining the relevance of the study by revealing negative trends in the development of the education infrastructure in the Arctic territories; reviewing Russian and foreign scientific literature to identify the scientific problem and the extent of its elaboration; determining and classifying the drivers of development of the object of research; working out and applying methodological tools to test the hypothesis put forward; and interpreting the results obtained.

The analysis of essential approaches to the term "education infrastructure" allowed us to determine the conceptual basis of the object of our study. Here the infrastructure of education, from the point of view of the component composition, is understood as a set of infrastructure facilities of preschool, school and vocational education, as well as their staffing with qualified specialists.

The work considers the object of research at the mesoregional (subregional) taxonomic level of spatial-territorial Arctic systems, i.e. in relation to specific local communities (consumers), which increases the objectivity of the results obtained.

The geography of the study was determined using an institutional approach and includes the Arctic mesoregions of the Arkhangelsk Oblast, Nenets Autonomous Okrug and the Komi Republic[1]. These territories together form the Arctic zone of the Northern macroregion (*Fig. 1*).

The region chosen for the study is characterized by the presence of similar socio-economic problems, has a special geostrategic status and serious natural resource potential, therefore, corresponds to A.G. Granberg's approach to the allocation of territorial systems, called problematic economic zoning (Granberg, 2006).
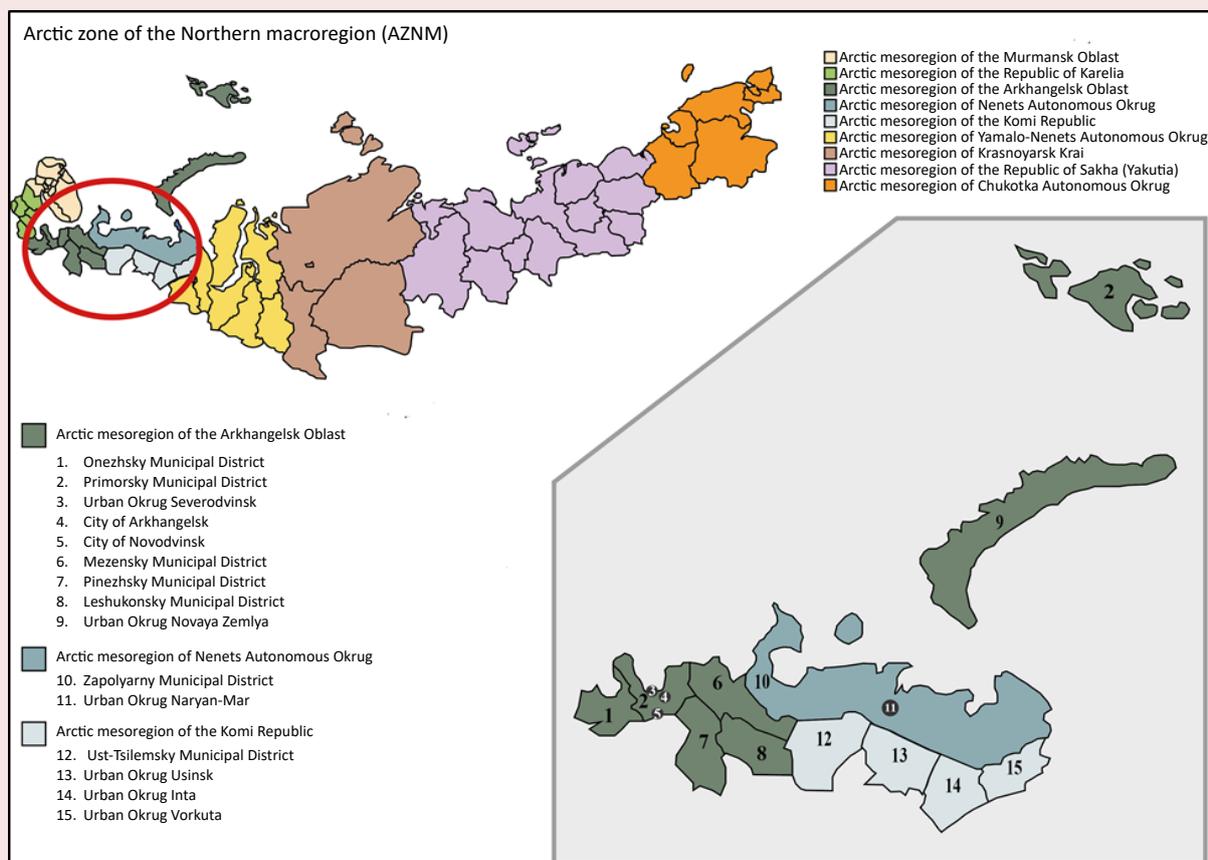
To substantiate the relevance of the study, we carried out a comparative analysis of the formed trends in the development of the education infrastructure in the selected territory. The system of indicators for the analysis of the object of research includes both absolute values of indicators and relative ones, that is, in relation to the dynamics of the number of consumers of educational services (*Tab. 1*).

The criteria for selecting indicators were the availability and accessibility of statistical data, the dynamics of indicators, and a sufficient length of the time series. As a result, 14 indicators were selected, including the characteristics of physical infrastructure facilities of preschool, school, secondary vocational and higher vocational education.

The analysis also includes indicators of staffing the education infrastructure at different levels. The length of the dynamic series in the analysis of trends is 14 years, since 2009, when Russia began implementing large-scale reforms in the social sphere, including through the implementation of national and federal projects and initiatives.

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[1] On the land territories of the Arctic zone of the Russian Federation: Presidential Decree 296, dated May 2, 2014; On state support for entrepreneurial activity in the Arctic zone of the Russian Federation: Federal Law 193-FZ, dated July 13, 2020; Spatial Development Strategy of the Russian Federation for the period up to 2025 (approved by RF Government Resolution 207-r, dated February 13, 2019).

Figure 1. Arctic zone of the Northern macroregion

Source: own compilation.

Table 1. Dynamics of education infrastructure indicators

No.	Indicator, unit of measurement	Arctic mesoregion								
		Arkhangelsk Oblast			Nenets Autonomous Okrug			Komi Republic		
		2009	2022	dynamics, %	2009	2022	dynamics, %	2009	2022	dynamics, %
1	Number of places in preschool educational institutions (kindergartens), units	29468	42246	**43.4**	3159	3899	**23.4**	11986	11613	**-3.1**
2	Number of places in preschool educational institutions (kindergartens) per 1 child aged 1 to 6, units per child	0.76*	1.05	**38.2**	0.89*	0.97	**9.0**	0.86	1.16	**34.9**
3	Number of teaching staff in preschool educational institutions, people	4087	4579	**12.0**	448	483	**7.8**	1426	1092	**-23.4**
4	Number of teaching staff in preschool educational institutions per 1 child aged 1 to 6, people per child	0.09*	0.11	**22.2**	0.13*	0.12	**-7.7**	0.10	0.11	**10.0**

End of Table 1

No.	Indicator, unit of measurement	Arctic mesoregion								
		Arkhangelsk Oblast			Nenets Autonomous Okrug			Komi Republic		
		2009	2022	dynamics, %	2009	2022	dynamics, %	2009	2022	dynamics, %
5	Number of general education organizations (schools), units	201	132	-34.3	40	26	-35.0	92	63	-31.5
6	Number of general education organizations (schools) per 100 students aged 7 to 17, units per 100 students	0.25*	0.16	-36.0	0.64*	0.36	-43.8	0.36	0.28	-22.2
7	Number of teachers, people	6050	4257	-29.6	685	496	-27.6	1625	1213	-25.4
8	Number of teachers per 100 students aged 7 to 17, people per 100 students	6.75*	5.05	-25.2	8.88*	6.82	-23.2	6.32	5.30	-16.1
9	Number of secondary vocational education organizations, units	31***	30	-3.2	3***	3	0.0	7	9	28.6
10	Number of secondary vocational education organizations per 10,000 people of the population aged 16 and over, units per 10,000 people	0.55***	0.56	1.8	0.91***	0.89	-2.2	0.53***	0.75	41.5
11	Number of higher education organizations, units	10**	5	-50.0	0**	0	0	3**	2	-33.3
12	Number of higher education institutions per 10,000 people of the population aged 18 and over, units per 10,000 people	0.18**	0.10	-44.4	0**	0	0	0.21**	0.17	-19.0
13	Total number of teaching staff, people	1915**	918	-52.1	0**	0	0	18**	29	61.1
14	The total number of teaching staff per 10,000 people of the population aged 18 and over, teachers per 10,000 people	34.00**	17.53	-48.4	0**	0	0	1.28**	2.50	95.3

Note. Due to the lack of official data of the indicator, the following year was chosen as the beginning of the dynamic series: *2012, **2013, ***2016.

Compiled according to: Federal State Statistics Service. Available at: https://rosstat.gov.ru/; Main information and computing center MIREA. Available at: https://monitoring.miccedu.ru/

By calculating the rates of changes in the indicators of the education infrastructure for the periods under consideration, we identified trends in the development of the object of our study. Based on the analysis of the data obtained, we can conclude that negative trends have formed in the development of the infrastructure of school and vocational education in all the Arctic mesoregions under consideration.

The deterioration of the education infrastructure in the northern and Arctic territories may contribute to an increase in the migration outflow, especially from rural areas. Thus, during the fourteen-year period the number of inhabitants of the Arctic zone of the Northern macroregion decreased by 9%, which is largely due to the mechanical movement of the population. At the same time, the system of strategic planning for the development of the

Arctic territories assumes preservation of permanent population by creating conditions for living and improving the quality of life, including providing access to quality educational services.

Foreign and domestic studies often consider the approach that the formation of social infrastructure has an impact on the socio-economic development of territories. However, recently the attitudes of able-bodied population have been changing, which notes the importance of having a high-quality social infrastructure on the territory, especially in the field of education. Researchers have determined the importance of the transformation of the social sphere in order to attract qualified personnel and positive demographic shifts, which is due to the need to transition to the knowledge economy in the development of northern territories (Pilyasov, 2009). Also, one of the main factors promoting spatial redistribution of human resources is the quality of life, which is also characterized by the level of education (Fauzer, Smirnov, 2020). All of the above confirms the high relevance of investigating the factors affecting the education infrastructure in the Arctic zone of the Northern macroregion.

Extent of elaboration on the topic

Since the early 1990s, the majority of Russia's Arctic regions have experienced population decline due to migration (Fauzer, Smirnov, 2020) and a decrease in the birth rate (Loginov, 2010), which affects population density in this area and leads to its "depopulation" (Emelyanova, 2019). M. Laruelle reveals three waves of "Arctic urbanization" (Laruelle, 2019). As a result of this process, as P.V. Sosin points out, there is an increase in the share of small settlements located in hard-to-reach places where social infrastructure is not developing (Sosin, 2011). The processes taking place in the Arctic territories lead to the closure of kindergartens and schools (Loginov, 2010) and cause an acute shortage of teaching staff, which is due to the high rates of migration of the working-age population by whole families (Shelomentsev et al., 2018).

Researchers engaged in Northern studies point out a process of "de-intellectualization of the Northern and Arctic territories" (Fauzer, Lytkina, 2017), which, among other things, is associated with the widespread use of drive-in drive-out work (Nuikina, 2013) and an increase in the burden on the able-bodied population by elderly people in the Northern and Arctic regions (Volgin et al., 2019).

Another feature of the North and the Arctic is the ethnicity of the territory (Lazhentsev, 2008), since more than 50% of the indigenous peoples of the North, Siberia and the Far East live there[2]. As a rule, indigenous peoples lead a nomadic lifestyle, which "hinders the pace of development of social infrastructure" (Sosin, 2011), including in the field of education. In particular, researchers note the need to take into account the peculiarities of indigenous minorities, as well as the knowledge of indigenous languages among the teaching staff when deciding on the placement of educational institutions (Emelyanova, 2019).

The above processes have identified a list of demographic and social and labor factors that have a direct impact on the creation, maintenance and development of the infrastructure of the education sector.

In most municipal entities, the main reason for the migration of able-bodied population was the absence of work or related difficulties. This is due to the closure of unprofitable and outdated production facilities in the Northern territories, which reduced their economic activity (Biktemirova et al., 2015).

Large resource and raw materials companies remain the basis of the economy of the Arctic regions, which is due to the nature of the development of the latter (Selin, Vyshinskaya, 2015). Researchers engaged in Northern studies point out that large mining companies spend significant funds

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[2] On approval of the List of indigenous peoples of the North, Siberia and the Far East of the Russian Federation: RF Government Resolution 536-r, dated April 17, 2006.

on the maintenance of social infrastructure facilities in settlements (Vasiliev, Selin, 2017); this serves as a kind of "compensation" projects (Novoselov et al., 2021). Sometimes such projects are implemented on the basis of public-private partnership, when the state attracts private capital to address socially significant tasks (Hodge, Greve, 2007).

Also, the Arctic regions are characterized by a high proportion of single-industry localities in the structure of settlements. The researchers note that the city-forming enterprises in the monosettlements are the central subjects of social policy; their social programs are also aimed at the development of social infrastructure facilities and their maintenance (Grachev et al., 2020). After the government has introduced benefits for enterprises investing in the formation and modernization of social infrastructure in the Northern municipalities, the level of corporate social responsibility of large businesses in the territories under consideration is increasing. Taking into account strategic guidelines of the state, major companies in the Arctic territories are currently most interested in innovative qualified personnel, which must be taken into account when developing the education infrastructure (Leksin, Porfiriev, 2015). In 2020 the RF Government adopted a package of federal laws on state support for entrepreneurship in the Arctic zone (provision of tax and administrative preferences); after that new investment processes were actively launched in the regions. The Arctic territories have become more attractive for doing business. The inflow of investments, including public ones, has an impact on the formation of the education infrastructure[3].

An important role in the development of the education infrastructure is assigned to the implemented state policy (Fomenko, Kotelevskaya, 2022). The implementation of state policy in the social sphere has recently been mainly carried out on the basis of project and strategic management, mainly through the use of financial mechanisms. Consequently, an important factor in the sustainable development of social infrastructure is the social orientation of regional and local budgets (Marmot, 2008).

Thus, economic factors such as industry specialization, corporate social responsibility and investment activity of enterprises operating in these territories have a significant impact on the education infrastructure. It is also worth considering the role of the state, which creates additional business support tools.

Russia's Northern and Arctic regions are distinguished by their remoteness (Pilyasov, 2009), which in relation to the education infrastructure is manifested in the problem of transport accessibility of educational institutions in remote areas (Davydenko et al., 2022; Nilsson, Larsen, 2020).

The next feature of the Arctic and Northern territories is their severe natural and climatic conditions, which complicates the construction of buildings and facilities, as well as their engineering equipment, and leads to the rise in their price (Streletskiy et al., 2019; Ramage et al., 2021). Researchers note the low level of engineering facilities in remote Northern and Arctic municipalities (Ryabova et al., 2013), which becomes a barrier to the construction of social infrastructure facilities in territorial planning.

The specifics of the Arctic territories form spatial and territorial factors affecting both the field of education and the social infrastructure as a whole.

A comparative analysis of the scientific literature allows us to conclude that the available studies mainly consider the impact of individual factors on the development of educational facilities and qualified personnel in this area at the regional level, as well as the lack of methodological tools for assessing the impact of factors on the formation

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[3] Roskruge M., Grimes A., McCann Ph., Poot J. (2010). Social capital and regional social infrastructure investment: Evidence from New Zealand. Wellington. Working Papers from Motu Economic and Public Policy Research.

and development of the education infrastructure, from the perspective of component composition, in the Arctic zone of the Northern macroregion. Such tools will make it possible to do the following: to assess the current stage of socio-economic development after the reform of the education system, which has a particularly strong impact on remote areas; take into account the strategic guidelines of public authorities for the development of the Arctic territories of the Northern macroregion forming a certain mesoregion; to quantify the impact of a complex of related factors; to take into account spatial-territorial and socio-economic features of development of the Northern and Arctic territories.

Our research is aimed at solving the scientific problem stated above.

Research materials and methods

As a result of determining the degree of elaboration on the problem, we put forward the following scientific hypothesis: the development of the education infrastructure in the Arctic zone of the Northern macroregion is influenced by a set of interrelated economic, demographic, spatial and territorial, and social and labor factors, and the degree of their influence is differentiated depending on the features of the North and the Arctic inherent in a particular mesoregion.

To test the hypothesis, we used the following methodological approach that includes three consecutive stages.

1. Comparative analysis of existing scientific approaches in determining the factors contributing to the education infrastructure development, taking into account specific features of the North and the Arctic. The result is a system of substantiated conjugate factors promoting the development of the object of research, including indicators that fully reflect the specifics of their influence in the Arctic territories (*Tab. 2*).

2. Correlation and regression analysis of the dependence of the education infrastructure indicators (effective feature) and factor indicators (factor features), including the following steps.

— *Forming a system of resultant and factor indicators (Tab. 3).*

Table 2. System of factors influencing the development of the education infrastructure in the North and in the Arctic

Factor	Features of the North and Arctic	Indicator (mesoregional level)
Economic factors		
Industry specialization	Raw materials orientation in economic specialization	Share of extractive enterprises in the total number of enterprises and organizations, %
Corporate social responsibility	Presence of large mining companies in the territory	Share of invested funds from large companies operating in the territory in the total amount of funds for social development, %
Scale of own production	Closure of unprofitable and outdated production facilities, high depreciation of fixed assets	Goods of own production shipped, works and services performed with the use of own means per capita, thousand rubles
Investment activity of organizations	High investment attractiveness of territories rich in natural resources	Investments in fixed assets carried out by organizations located on the territory, per capita, rubles
Budgetary security	Social orientation of the budget	Share of local budget expenditures on social policy in total expenditures, %
Demographic factors		
Population change	Population decline	Total population growth rate, ‰
Population migration	High migration outflow	Retirement ratio, ‰
Birth rate	Decrease in the birth rate	Total fertility rate, ‰
Ethnicity	Presence of indigenous small-numbered peoples of the North	Share of indigenous small-numbered peoples of the North in the total population, %
Spatial and territorial factors		
Natural and climatic conditions	Severe natural and climatic conditions	Bioclimatic index of severity of climatic regime

End of Table 2

Factor	Features of the North and Arctic	Indicator (mesoregional level)
Urbanization of the territory	Predominance of small rural settlements (population less than 200 people)	Share of small settlements in the total number of settlements, %
Depopulation of the territory	Reduction of the rural population	Share of rural population in the total population of the territory, %
Settlement of the population	Low population density	Population density, people/km^2
Remote location of the territory	Low transport accessibility of territories	Density of paved public roads, at the end of the year, km/km^2
Extent of economic diversification	Large number of single-industry settlements (single-industry towns) in the structure of settlements	Share of single-industry municipalities in the total number of settlements, %
Engineering equipment of the territory	Low level of engineering facilities in rural remote areas	Index of equipment of the territory with water supply, sewerage and heat network
Social and labor factors		
Human capital	Reduction in the share of highly qualified personnel	Share of highly qualified personnel in the total number of the employed, %
Form of labor	Wide application of drive-in drive-out work	Share of the population working in shifts in the total number of the employed, %
Human resources	Increasing the demographic burden by pensioners	Coefficient of pensioners' demographic burden

Table 3. System of resultant and factor indicators for the development of the
education infrastructure in the Arctic zone of the Northern macroregion

Area	Indicator	Unit of measurement
1. Resultant indicators (education infrastructure)		
Preschool education	1.1. Number of places in preschool educational institutions (kindergartens)	units
	1.2. Number of teaching staff in preschool educational institutions	people
School education	1.3. Number of general education organizations (schools)	units
	1.4. Number of teachers	people
2. Factor indicators		
Economic factors		
Investment activity of organizations	2.1. Investments in fixed assets carried out by organizations located on the territory (without SMEs)	rubles
Scale of own production	2.2. Goods of own production shipped, works and services performed using own means (without SMEs)	rubles
Budgetary security	2.3. Volume of local budget expenditures on social policy	rubles
Demographic factors		
Change in the number of population	2.4. Number of population	people
Birth rate	2.5. Number of live births	people
Population migration	2.6. Number of those who left the territory, the value of the indicator for the year	people
Spatial and territorial factors		
Remote location of the territory	2.7. Length of paved public roads, at the end of the year	kilometers
Engineering equipment of the territory	2.8. Single extension of water supply network at the end of the year	kilometers
	2.9. Single length of sewer network at the end of the year	kilometers
	2.10. Length of heat and steam networks in two-pipe calculation	kilometers
Depopulation of the territory	2.11. Number of rural population	people
Social and labor factors		
Labor recources	2.12. Average number of employees of organizations	people

All factor indicators of the education infrastructure development are divided into four groups. Economic factors are represented by three indicators that characterize the investment activity of organizations and the scale of their own production as the basis of a source for spending on social needs; and the actual expenditures of the local budget on social policy show not only the budgetary provision of the territory, but also priorities in spending funds. Demographic indicators take into account the natural and mechanical dynamics of the population – the end users of the education infrastructure. The need for educational facilities directly depends on demographic factors. Spatial and territorial factors are of particular importance in the Northern and Arctic territories, taking into account their vastness and low population density. Poor development of the road network and the engineering infrastructure of the territory affects the transport accessibility of the education infrastructure facilities, their quality, the potential for construction and placement of new facilities. Reduction of rural population, primarily due to the migration of young people, leads to the optimization of the education infrastructure and, ultimately, depopulation of the territory. Social and labor factors are represented by an indicator of availability of labor resources in the Arctic territories, characterized by a reduction in the share of highly qualified personnel, widespread use of drive-in drive-out employment and an increase in the pensioners' demographic burden.

The main criteria for the selection of indicators were the presence of the absolute value and dynamics of the indicator, the quantitative expression of the indicator and the sufficient length of the time series (2009–2022, 14 years). As a result of application of the listed criteria, indicators of the development of vocational education (lack of dynamics of indicators) and several factor indicators were excluded from the study. The correlation matrix was also analyzed to exclude multicollinear indicators.

– *Collecting and systematizing the database of selected indicators (constructing dynamic time series).*

Due to the lack of indicators specifically for the studied mesoregions, data were collected and summarized for municipalities included in each Arctic mesoregion. Separate subdivisions of institutions are taken into account as independent units of the education infrastructure.

– *Regression analysis of resultant and factorial time series.*

The closeness of the connections was normalized by the value of the approximation coefficient R^2. When checking, the p-value did not exceed 0.05; F-statistics did not exceed tabular values. Thus, the degree of reliability of the results was at least 95%. The criterion for the relationship between the indicator and the factor is the numerical value of the determination coefficient above 0.5 on the Cheddock scale. Special emphasis is given to the study of the influence of factors on the education infrastructure that have a high strength of relationship (above 0.7).

3. At the final stage, we carried out interpretation of the obtained results of the influence of economic, demographic, spatial-territorial and socio-labor factors on the development of the education infrastructure in the Arctic zone of the Northern macroregion. The result of this stage was the differentiation of the mesoregions by factor characteristics.

Thus, theoretical and empirical methods were used in this study. To determine the existing problems, methods of statistical analysis, grouping and systematization based on identifying the pace of change were applied. The review of the degree of theoretical study of the problem is based on a comparative analysis of the ideas and approaches of Russian and foreign scientists. Methodological tools also include econometric methods for determining the degree of influence of factors on the development of the education infrastructure.

Results and discussion

The obtained results of correlation and regression analysis confirmed the hypothesis of our study. All the factors under consideration have an impact on the development of the education infrastructure in the selected mesoregions. However, different territorial systems have their own dominant factors (*Tab. 4*).

Economic factors have a significant impact on the development of the education infrastructure in Nenets Autonomous Okrug. This confirms the thesis that in territories characterized by a drive-in drive-out mode of economic development (a large number of nonpermanent population) and raw materials specialization, economic factors prevail over social and labor ones. For example, the

Table 4. Results of the correlation and regression analysis, the value of the coefficient of determination

Factors			Arctic mesoregion	1. Resultant indicators (education infrastructure)			
				1.1	1.2	1.3	1.4
2. Factor indicators	Economic	2.1	Arkhangelsk Oblast	-	-	0.65	0.68
			Nenets Autonomous Okrug	-	-	-	-
			Komi Republic	-	-	-	-
		2.2	Arkhangelsk Oblast	-	-	0.51	0.6
			Nenets Autonomous Okrug	**0.92**	**0.88**	**0.95**	**0.72**
			Komi Republic	-	-	-	-
		2.3	Arkhangelsk Oblast	**0.92**	**0.89**	**0.77**	**0.83**
			Nenets Autonomous Okrug	-	-	-	-
			Komi Republic	-	-	**0.7**	**0.78**
	Demographic	2.4	Arkhangelsk Oblast	-	-	**0.94**	**0.99**
			Nenets Autonomous Okrug	**0.78**	-	**0.73**	-
			Komi Republic	-	-	**0.79**	**0.97**
		2.5	Arkhangelsk Oblast	-	-	**0.93**	**0.97**
			Nenets Autonomous Okrug	-	-	-	-
			Komi Republic	-	-	**0.81**	**0.93**
		2.6	Arkhangelsk Oblast	-	-	**0.75**	**0.84**
			Nenets Autonomous Okrug	0.5	-	0.49	-
			Komi Republic	**0.95**	**0.9**	0.53	**0.8**
	Spatial and territorial	2.7	Arkhangelsk Oblast	-	-	-	-
			Nenets Autonomous Okrug	**0.87**	0.52	**0.95**	-
			Komi Republic	-	-	-	-
		2.8	Arkhangelsk Oblast	-	-	**0.93**	**0.91**
			Nenets Autonomous Okrug	**0.77**	-	**0.88**	**0.87**
			Komi Republic	-	-	**0.75**	**0.81**
		2.9	Arkhangelsk Oblast	-	-	**0.84**	**0.75**
			Nenets Autonomous Okrug	0.64	-	0.61	0.5
			Komi Republic	**0.84**	**0.89**	**0.73**	**0.82**
		2.10	Arkhangelsk Oblast	**0.91**	-	**0.86**	**0.92**
			Nenets Autonomous Okrug	**0.92**	0.58	**0.87**	**0.79**
			Komi Republic	-	-	0.69	**0.88**
		2.11	Arkhangelsk Oblast	-	-	-	-
			Nenets Autonomous Okrug	-	-	0.57	-
			Komi Republic	0.57	0.59	-	-
	Social and labor	2.12	Arkhangelsk Oblast	**0.91**	**0.96**	**0.89**	**0.96**
			Nenets Autonomous Okrug	-	-	-	-
			Komi Republic	**0.84**	**0.83**	-	**0.83**

scale of own production affects the infrastructure of preschool and school education and their staffing due to the replenishment of local budgets and the implementation of corporate social responsibility programs of economic entities. The social orientation of the budget does not affect the education infrastructure in Nenets Autonomous Okrug and, on the contrary, strongly affects it in the Arkhangelsk Oblast due to the specifics of interbudgetary relations between these regions – a significant part of social services for residents of the district are provided by regional institutions.

Analyzing the results that we have obtained concerning the influence of demographic factors on the development of the object of our research, it is worth noting that the main predominant indicator is the change in the number of population. It is the need of the population for educational facilities that affects their quantitative composition, since social infrastructure is created for people. An additional argument is the strong influence of the factor such as the engineering arrangement of the territory. The spatial placement of the education infrastructure facilities is based on the existing state norms and standards for providing heat and water supply communications.

Negative migration processes in the old industrial mesoregions of the Arkhangelsk Oblast and the Komi Republic have a direct impact on the staffing of the education sector – highly qualified specialists in the social sphere leave the territory. For example, these dependencies in the Komi Republic can be confirmed by active migration from the Arctic territories associated with a decrease in economic activity or the complete closure of coal mines, which formed the basis of the structure of the economy.

Spatial and territorial factors also affect all indicators of development of the education infrastructure. A feature of Nenets Autonomous Okrug is the high periphery of the territory, which manifests itself in extremely poor provision of transport facilities. In general, the factors such as periphery and an insufficient provision of engineering equipment in the territory of all the Arctic mesoregions under consideration have a greater impact on the infrastructure of school education, including the provision of school teachers.

The average number of employees of organizations is an indicator of the provision of labor resources in the territory, the most important socio-labor factor promoting socio-economic development in the territory. This factor strongly influences the development of the education infrastructure in the Arctic mesoregions of the Arkhangelsk Oblast and the Komi Republic. This is due to their economic specialization related to the manufacturing industry and the need for a permanent population.

Takeaways and conclusion

In the course of the work, we assessed the influence of a set of factors on the formation and development of social infrastructure regarding its components. The peculiarity of the performed research lies in its complexity and implementation at the mesoregional level, taking into account territorial features of the Russian North and the Arctic and the strategic guidelines of public authorities, which became the basis for development of our own methodological tools. The methodological framework we propose includes a sequential algorithm and step-by-step detailing of the assessment of the impact of substantiated conjugate factors on the development of the education infrastructure, as well as a system of indicators that fully reflect the features of their influence in the Arctic territories.

As a result, the hypothesis was confirmed that the influence of the presented factors on the education infrastructure in the Arctic zone of the Northern macroregion is differentiated depending on the nature and pace of development of the territories under consideration and also on the implementation of state policy.

The practical significance of the research findings is determined by the possibility of their application by federal and regional authorities when developing the education infrastructure in the Arctic, taking into account the specifics and degree of influence of economic, demographic, spatial and territorial, and social and labor factors on the development of the education infrastructure in a particular mesoregion.

For example, the development of the education infrastructure in the Arctic mesoregion of the Arkhangelsk Oblast is strongly influenced by the amount of funding from local budgets. This dependence looks logical due to the considerable deficit of local budgets that have been vested with the powers to maintain preschool and school infrastructure. This fact should be taken into account by regional and local authorities at the stage of planning the structure of budgets for the planning period and the implementation of intergovernmental transfers. A telling example can be found in the strong impact of population changes on the education infrastructure in the Arctic mesoregion of the Komi Republic, where the reduction in the need for schools and kindergartens is accompanied by a natural process of their closure. The authorities need to stabilize the dynamics of the population, first of all to reduce migration decline, providing the population with employment and a decent quality of life. The provision of the transport and engineering infrastructure in Nenets Autonomous Okrug will contribute to the development of social infrastructure in the region, taking into account the increasing needs due to population growth.

The results obtained are recommended to be taken into account when developing and adjusting strategic and program documents aimed at promoting socio-economic development in the Northern and Arctic territories in general and in the field of education in particular.

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Information about the Authors

Lyudmila V. Voronina — Candidate of Sciences (Economics), Senior Researcher, N. Laverov Federal Research Center for Integrated Arctic Research of the Ural Branch of the Russian Academy of Sciences (20, Nikolsky Avenue, Arkhangelsk, 163020, Russian Federation); Associate Professor, Northern (Arctic) Federal University named after M.V. Lomonosov (17, Northern Dvina Embankment, Arkhangelsk, 163002, Russian Federation; e-mail: Ludmila.science@yandex.ru)

Aleksei V. Grigorishchin — Senior Lecturer, Northern (Arctic) Federal University named after M.V. Lomonosov (17, Northern Dvina Embankment, Arkhangelsk, 163002, Russian Federation; e-mail: a.grigorischin@narfu.ru)

Dilmurad B. Iakhiaev — Senior Lecturer, deputy executive director — head of the expert and analytical department of the directorate of the World-Class Scientific and Educational Center "Russian Arctic: New Materials, Technologies and Research Methods", Northern (Arctic) Federal University named after M.V. Lomonosov (17, Northern Dvina Embankment, Arkhangelsk, 163002, Russian Federation; e-mail: dilmurad-92@mail.ru)