EDITORIAL
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Development of higher education in the regions of Russia: pedagogical staff number

Iuliia Pinkovetskaia [1]

1. Ulyanovsk State University, Russia
pinkovetskaia@gmail.com

Abstract

This research aimed to assess the indicators that characterize the number of teaching staff at universities and other higher education institutions (HEIs) in the regions of Russia. These indicators were: (1) the number of teachers per thousand working-age residents of each of the regions, (2) the average number of teachers per HEI in the region, (3) the proportion of teachers who have a Doctor of Science (DSc) and a Doctor of Philosophy (PhD) degree in the number of teachers working in HEIs in the region, and (4) the number of students per teacher working in HEIs. We used official statistical information of 82 regions of Russia. We found that, on average, there are slightly more than two teachers working in HIEs per thousand working-age residents. The average number of teachers per HIE in Russia is 158. In universities, the average number of students per teacher is more than 20. The proposed methodological approach and the obtained results are a scientific novelty, since the assessment of regional characteristics of the number of teaching staff in the regions of Russia has not been carried out before.

Keywords: higher education institutions, universities, academic teaching staff, students, regional development

Desarrollo de la educación superior en las regiones de Rusia: número de personal pedagógico

Resumen

El propósito de la investigación fue evaluar los indicadores que caracterizan el número de docentes en las universidades y otras instituciones de educación superior (IES) en las regiones de Rusia. Estos indicadores fueron: (1) el número de maestros por cada mil residentes en edad laboral en cada región, (2) el número promedio de maestros por IES en la región, (3) la proporción de maestros con un doctorado en ciencias (DSc) y un doctorado (PhD) en el número de maestros de IES en la región y (4) el número de estudiantes por maestro de IES. Se utilizó información estadística oficial de las 82 regiones de Rusia. Se encontró que, en promedio, hay un poco más de dos maestros trabajando en IES por cada mil residentes en edad laboral. El número medio de maestros por IES en Rusia es de 158. En las universidades, la media de estudiantes por profesor es superior a 20. El enfoque metodológico propuesto y los resultados obtenidos son una novedad científica, ya que la evaluación de las características regionales del número de docentes en las regiones de Rusia no se ha llevado a cabo antes.

Palabras clave: instituciones de educación superior, universidades, personal docente, estudiantes, desarrollo regional

Desenvolvimento do ensino superior nas regiões da Rússia: número do pessoal pedagógico

Resumo

A pesquisa visou a avaliar os indicadores que caracterizam o número de professores nas universidades e outras instituições de ensino superior (IES) nas regiões da Rússia. Esses indicadores foram: (1) o número de professores por mil habitantes em idade de trabalhar em cada região, (2) o número médio de professores por IES na região, (3) a proporção de professores doutorados em ciências (DSc) e doutorados (PhD) no número de professores de IES na região e (4) o número de alunos por professor de IES. Foram utilizadas informações estatísticas oficiais das 82 regiões da Rússia. Constatou-se que, em média, há pouco mais de dois professores trabalhando em IES para cada mil residentes em idade de trabalhar. O número médio de professores por IES na Rússia é de 158. Nas universidades, o número médio de estudantes por docente ultrapassa 20. A abordagem metodológica proposta e os resultados obtidos são uma novidade científica, já que a avaliação das características regionais do número de professores nas regiões russas não foi realizada antes.

Palavras-chave: instituições de ensino superior, universidades, pessoal docente, estudantes, desenvolvimento regional

Higher education institutions (HEIs) in Russia carry out student training on three programs: the bachelor (four years of study), specialist degree (five years), and master's degree (two to three years). The structure of higher education in Russia includes institutions such as universities, academies, institutes, and higher schools. The largest HEIs, along with the main campus, also have branches located in other cities. In Russia, there are generally three categories of teachers in HEIs. The first category includes teachers who have defended their doctoral dissertation and hold a Doctor of Science (DSc) degree. The second category includes people who have defended their dissertation candidacy in science and hold a PhD degree. It should be noted that a doctoral dissertation in Russia can be defended only if you have a PhD degree. Teachers of HEIs who belong to the third category do not have a DSc nor a PhD degree. Having a DSc degree makes it possible to hold the position of full professor. Teachers who have a PhD degree hold associate professor positions. Teachers belonging to the third category occupy the positions of assistant and senior lector.

To date, the sphere of higher education in Russia has undergone a significant development. In 2020, there were 1259 specialized institutions operating in this economic sector (Federal State Statistics Service, 2021). Out of the total number of HEIs, 62% are state-owned, and 38% are private. The total number of teachers working at universities and other HEIs was 223 088. Out of these, 35 039 have DSc degrees, and 129 328 have PhD degrees. The total number of students enrolled in higher education programs in 2020 was 4 049 333. The two main types of student training in higher education programs in Russia were full-time and part-time. Out of the total number of students who received higher education in 2020, 60% were full-time students and 40% were part-time students.

The increasing role of higher education (Jaspers, 1960) contributes to the significant social and economic development of modern states. In developed and developing countries, both universities and other HIEs have become widespread.

In the twenty-first century, most states have created conditions that ensure mass access of the population to higher education (Guri-Rosenblit et al., 2007). The total number of students in all countries in 2016 was 218 million, which is 1.5 times more than in 2006 (Cour des Comptes, 2019). To solve the problems of higher education, the availability of pedagogical staff capable of teaching students according to appropriate programs is a necessary condition. Taking this into account, one of the urgent scientific problems is the assessment of indicators to characterize the staff: professors, associate professors, and other categories of teachers who ensure the availability of higher education (Douglas, 2011; Stiglitz, 2014). Our research aimed to this issue. Studying the current level of capability to solve this problem is important for both state bodies that regulate activities in this area, and directly for potential students.

Despite the extensive research on the problem of the development of higher education, until now, not enough attention has been paid to the regional peculiarities of solving this problem. The presence of institutions in the regions that teach students according to relevant programs (Abel & Deitz, 2011; Ciriaci, 2014) increases the attractiveness of the regions, positively affects their economic growth, and, most importantly, ensures the retention of school graduates in the regional labor market. All this determines the increased interest in the study of regional

aspects of the development of higher education. Our article responds to the calls made in several scientific publications (Cervantes, 2017; Unger & Polt, 2017) to study the existing features of higher education by region.

The purpose of our study was to assess the indicators that characterize the number of teaching staff at universities and other HEIs in the regions of Russia. Our paper is aimed at obtaining a certain empirical and methodological contribution to the knowledge of the presence of science personnel in the regions that teach students in higher education programs. This contribution consists of the method proposed by the author for modeling the estimation of the number of professors and teachers in universities and other HEIs in the regions of Russia using the density functions of the normal distribution. The empirical contribution is related to the determination of the average values and standard deviations by region of indicators such as: number of teachers working at universities and HEIs per thousand residents of the region, proportion of professors in the whole number of teachers, proportion of associate professors in the whole number of teachers, and number of teachers per hundred students. In addition, the regions with the maximum and minimum values of these indicators are determined.

Literature review

Several recent scientific publications have been devoted to the problem of assessing aspects of the development of higher education in Russia such as the number of the pedagogical staff of higher education institutions and the current ratio of the number of teachers and students. A brief description of these publications is given in table 1.

Table 1

Scientific publications describing the activities of pedagogical staff

Authors	Problems under study	Objects of study	Type of indicators
Anisimova and Babich (2016)	Estimation of the number of students per teacher in HEIs in 2010-2014.	Russia	Relative
Maksimova (2019)	Change in the number of teaching staff in HEIs for the period 2005-2018.	Russian regions	Absolute
Kurilova (2020)	Analysis of changes in the number of research staff at universities in 2015-2019.	Russia	Absolute
Vlasova (2021)	Dynamics of the number of personnel engaged in educational activities in higher education.	Russia	Absolute
Lomonosov (2013)	Justification of the optimal standard for the number of teaching staff.	Russia	Absolute
Romanov (2018)	Financing the remuneration of teachers who teach students under bachelor's and master's degree programs in 2016-2017.	Russia	Absolute
Popova and Vdovina (2017)	The number of professors and teachers at universities in 2017.	Penza Region	Absolute
Vadimova (2015)	Dynamics of changes in the number of students per teacher for the period from 2012 to 2015.	Russia	Relative

Vardanyan and Keshishyan (2020)	Analysis of the number of teachers of HEIs who had academic degrees in 2014-2018.	Russia	Absolute
Kirillina (2015)	Study of the ratio of the number of students and the number of research and teaching staff at universities according to data for 2007-2012 per teacher for the period from 2012 to 2015.	Russia	Relative
Melikyan (2021)	Trends in the growth of the share of teachers with an academic degree in the total number of employees in the Russian higher education system.	535 universities	Index

Based on the information given in table 1, it can be stated that the problem of research on the number of teachers who work in higher education programs is relevant in Russia. Most of the reviewed studies analyzed the number of teachers, of students, and the number of institutions in Russia as a whole. At the same time, a comprehensive assessment of the distribution of the number of teachers in all regions of Russia has not been sufficiently reflected in scientific publications. It can be noted that a comparative analysis of relative indicators that allow us to assess the regional characteristics of HEIs was not carried out in most studies. Thus, absolute indicators were given in 70% of the studies shown in the table. Taking this into account, it seems appropriate to conduct a comparative analysis of the existing relative—specific—indicators that characterize the achieved level of activity of teaching staff in all regions of Russia.

Methodology

The pedagogical staff in HEIs considered in this paper carried out training of students in 2020. The bachelor, the specialist degree, and master's degree programs were considered.

The research process included fourth stages.

- At the first stage, initial data were set to characterize: the number of universities and other HEIs, the number of teaching staff by region in 2020, and the number of students enrolled in higher education programs that year. In addition, empirical data on the number of working-age residents in these regions were collected.

- At the second stage, we calculated indicators that characterize: the number of teachers per thousand working-age residents of each of the regions, the average number of teachers per HEI in the region, the proportion of teachers who have a DSc and PhD degree in the number of teachers working in HEIs in the region, and the number of students per teacher working in HEIs.

- At the third stage, the distribution of indicators by region was assessed based on the development of mathematical models.

- At the fourth stage, the average values of indicators for the regions of Russia and the ranges in which the values of these indicators are located for most of them were determined.

The study used official statistical information for 2020 on the number of HEIs and teachers in the 82 regions of Russia (Ministry of Science and Higher Education of the Russian Federation,

2021). In addition, we used empirical data on the population for each region in 2020 (Federal State Statistics Service, 2021).

In our study, three hypotheses were tested:

1. The pedagogical staff providing training for students in higher education programs is currently present in all regions of Russia.

2. The values of indicators by region have a small variation—that is, they are homogeneous.

3. The regions characterized by the maximum and minimum values for each of the four indicators are located in different federal districts.

The assessment of the values of the four considered indicators was carried out on the basis of the economic and mathematical modeling of the initial empirical data. As models, we used the density functions of the normal distribution. The method for developing them and estimating the values of relative cost indicators was proposed by the author. Some aspects of the use of the methodology are presented in the works of Pinkovetskaia and Slepova (2018) and Pinkovetskaia et al. (2021). During the development of the functions, the initial empirical data were grouped according to the ranges of changes in the values of the indicators. These data groups can be geometrically represented in the form of corresponding histograms. Data approximation using normal distribution functions was carried out using generally accepted statistical methods. It is important to note that the average values of the considered indicators and their standard deviations for the density functions of the normal distribution were displayed in the formulas of the developed functions themselves. Therefore, by constructing a specific function, we get the specified parameters of the considered indicators without additional calculations.

The obtained functions allowed us to determine the average values of each of the four indicators for the regions under consideration, and the ranges of their change characteristic of most regions. In addition, the study identified regions in which the considered indicators have values above the upper and below the lower boundaries of the ranges. The boundaries of the indicator range for 68% of the regions were determined based on the average values of the indicators and the corresponding standard deviations. The lower bound of the interval is equal to the difference between the mean and the standard deviation, and the upper bound is equal to their sum.

Modeling and results

During the computational experiment, economic and mathematical modeling was carried out on the basis of empirical data. The models that describe the distributions y_1 ; y_2 ; y_3 ; y_4 of the four indicators x_1 ; x_2 , %; x_3 , %; x_4 across all 82 Russian regions are shown below:

- the number of teachers working in HEIs per thousand working-age residents in the region:

$$y_1(x_1) = \frac{82.05}{1.03 \times \sqrt{2\pi}} \cdot e^{-\frac{(x_1 - 2.16)^2}{2 \times 1.03 \times 1.03}}$$

(1)

- the average number of teachers per HEI in the region:

$$y_2(x_2) = \frac{5062.57}{67.40 \times \sqrt{2\pi}} \cdot e^{-\frac{(x_2 - 158.62)^2}{2 \times 67.40 \times 67.40}}$$

(2)

- the proportion of teachers who have a DSc and PhD degree in the number of teachers working in HEIs in the region:

$$y_3(x_3) = \frac{384.75}{5.79 \times \sqrt{2\pi}} \cdot e^{-\frac{(x_3 - 74.83)^2}{2 \times 5.79 \times 5.79}}$$

(3)

- the number of students per teacher working in HEIs:

$$y_4(x_4) = \frac{287.02}{4.17 \times \sqrt{2\pi}} \cdot e^{-\frac{(x_4 - 20.46)^2}{2 \times 4.17 \times 4.17}}$$

(4)

We tested the quality of functions 1 to 4 using criteria of the Kolmogorov-Smirnov, the Pearson, and the Shapiro-Wilk tests. Principles of using these criteria are given in the scientific literature (Afeez et al., 2018; Rahman & Wu, 2013; Razali & Yap, 2011; Seier & Bonett, 2002; Yap & Sim, 2011; Yazici & Asma, 2007). Calculated values of criteria are shown in table 2.

Table 2

Calculated values of criteria

Indicators	Criteria		
	The Kolmogorov-Smirnov test	The Pearson test	The Shapiro-Wilk test
The number of teachers working in HEIs per thousand working-age residents in the region	0.04	1.54	0.98
The average number of teachers per HEI in the region	0.06	3.32	0.96
The proportion of teachers who have a DSc and PhD degree in the number of teachers working in HEIs in the region	0.05	4.16	0.95
The number of students per teacher working in HEIs	0.06	3.18	0.96

Information given in column 2 of table 2 showed that all calculated values are less than the critical value in the Kolmogorov-Smirnov test (0.174) at significant level equal 0.05. Data in column 3 are less than the critical value of the Pearson criterion (9.49). Data in column 4 exceed the critical value 0.93 of the Shapiro-Wilk test with significant level of 0.01. Thus, the computational experiment showed that all four developed functions have high quality.

At the next stage of the study, the values of indicators that characterize the number of pedagogical personnel working at universities and other HEIs in the regions of Russia were determined. The values of the indicators, the average by region, are shown in column 2 of table 3. The average values were determined on the base of functions 1 to 4. The third column indicates the standard deviation for discussing indicators. The values of the indicators that characterize the upper and lower

boundaries of the intervals corresponding to most regions are shown in column 4. We calculated both the lower limits as the difference between the average value and the standard deviation, and the upper limits as the sum of the average value and the standard deviation.

Table 3

Values of indicators describing the saturation of Russian regions with teachers working at universities and HEIs

Indicator numbers	Average values	Standard deviation	Values for most regions
The number of teachers working in HEIs per thousand working-age residents in the region.	2.16	1.03	1.13-3.19
The average number of teachers per HEI in the region.	158.62	67.4	91.22-226.02
The proportion of teachers who have a DSc and PhD degree in the number of teachers working in HEIs in the region (%).	74.83	5.79	69.04-80.62
The number of students per teacher working in HEIs.	20.46	4.17	16.29-24.63

Discussion

An analysis of empirical data for 2020 showed that there are HEIs in all 82 regions of Russia. Accordingly, the teaching staff was also in each region. Thus, the first hypothesis was confirmed.

The data in table 3 show that the average number of teachers in all regions of Russia was almost 2.2 per thousand residents of working age. In most regions, the values of this indicator were in the range from 1.1 to 3.2 in 2020.

On average, there were 158.6 people belonging to the scientific and pedagogical staff per HEI in all regions. The values of indicators for most regions varied from 91.2 to 226.0 teachers. The relatively small value of the number of teaching staff per HEI is due to the fact that in the regions, along with independent universities, there is a large number of relatively small branches providing educational services. A characteristic feature of these branches is their narrow specialization in certain areas of student training. This specialization follows from the industry affiliation of enterprises located in specific cities.

The average value for the regions of Russia of the proportion of teachers who have DSc and PhD degrees working in HEIs in 2020 amounted to almost 75% of the total number of teachers of HEIs. That is, three out of every four teachers have an academic degree. The values of this indicator, typical for most regions, ranged from 69% to 80%. It should be noted that by now, even in regions where there are difficulties with the training of highly qualified teachers (DSc and PhD), their share in the total number of teachers exceeded 55%.

The average value of the number of students per teacher working in HEIs in all regions of Russia was 20.5. The values of this indicator, typical for most regions, ranged from 16.3 to 24.6 students. This is slightly more than the average values for OECD countries, which range from 10 to 20 students per teacher (OECD, 2019).

To test hypothesis 2 on the differentiation of indicators by region, an analysis of the degree of variation of each indicator presented in table 3 was carried out. To do this, we used the standard deviations shown in column 3. The variation indices are as follows:

- for the first indicator: 48%.

- for the second indicator: 42%.

- for the third indicator: 8%.

- for the fourth indicator: 20%.

The analysis showed that there was no significant—more than 33%—differentiation of the values of two of the four indicators in the regions under consideration. That is, hypothesis 2 about the homogeneity of the values of indicators by region was partially confirmed.

The next step was to determine the regions of Russia in which the maximum and minimum values of each indicator were marked. In this case, the maximum values are those that exceed the upper limits of the ranges specified in column 4 of table 3, and the minimum values are those that are less than the lower limits of the specified ranges. The results of this analysis are shown in table 4. Along with the lists of regions, this table also shows the values of indicators by region and the federal districts of the regions to which they belong.

Table 4

Characteristics of Russian regions with maximum and minimum indicator values

Indicators	Region	Value	Federal district
	With maximum values of indicators		
	Novosibirsk Region	3.2	Siberian
	Orel Region	3.3	Central
	Tatarstan Republic	3.3	Privolzhsky
	North Ossetia-Alania Republic	3.5	North Caucasian
	Voronezh Region	3.5	Central
	Tomsk Region	5.8	Siberian
	Moscow City	6.4	Central
The number of teachers working in HEIs per thousand working-age residents in the region	Saint Petersburg City	6.8	North-West
	With minimum values of indicators		
	Chukotka autonomous District	0.1	Far Eastern
	Leningrad Region	0.2	North-West
	Sakhalin Region	0.5	Far Eastern
	Jewish Autonomous Region	0.8	Far Eastern
	Murmansk Region	0.8	North-West
	Kamchatka Territory	0.8	Far Eastern
	Moscow Region	0.9	Central
	Ingushetia Republic	1.0	North Caucasian
	Tyumen Region	1.0	Ural

	With maximum values of indicators		
	Novgorod Region	227.5	Privolzhsky
	Novosibirsk Region	256.0	Siberian
	Chechen Republic	267.5	North Caucasian
	Kostroma Region	274.0	Central
	Kabardino-Balkar Republic	276.7	North Caucasian
	Krasnoyarsk Territory	280.4	Siberian
	Mordovia Republic	283.2	Privolzhsky
	Mari El Republic	288.7	Privolzhsky
	Moscow City	310.8	Central
	Saint Petersburg City	311.2	North-West
Average number of teachers per HEI in the region	Tomsk Region	366.2	Siberian
	With minimum values of indicators		
	Leningrad Region	24.2	North-West
	Kamchatka Territory	31.6	Far Eastern
	Murmansk Region	44.8	North-West
	Moscow Region	63.4	Central
	Pskov Region	68.1	North-West
	Jewish Autonomous Region	68.1	Far Eastern
	Kaluga Region	75.8	Central
	Sakhalin Region	76.1	Far Eastern
	Smolensk Region	79.4	Central
	Lipetsk Region	85.0	Central
	With maximum values of indicators		
	Kursk Region	81.3%	Central
	Ingushetia Republic	81.4%	North Caucasian
	Tula Region	82.2%	Central
	Bryansk Region	82.8%	Central
	Orel Region	83.3%	Central
	Stavropol Territory	83.4%	South
	Jewish autonomous Region	83.9%	Far Eastern
	Tambov Region	84.9%	Central
	Mordovia Republic	86.3%	Privolzhsky
	Adygea Republic	86.4%	North Caucasian
	With minimum values of indicators		
The proportion of teachers who have a DSc and PhD degree in the number of teachers working in HEIs in the region	Tyva Republic	55.9%	Siberian
	Primorsky Territory	61.7%	Far Eastern
	Kostroma Region	62.9%	Central
	Sakha Republic	62.9%	Far Eastern
	Sevastopol	63.1%	South
	Novosibirsk Region	63.6%	Siberian
	Khabarovsk Territory	65.3%	Far Eastern
	Sakhalin Region	66.5%	Far Eastern
	Krasnoyarsk Territory	67.3%	Siberian
	Chechen Republic	67.9%	North Caucasian
	Moscow Region	68.1%	Central
	Karelia Republic	68.3%	North-West
	Sverdlovsk Region	68.4%	Ural

	With maximum values of indicators		
	Vologda Region	24.6	Central
	Magadan Region	25.3	Far Eastern
	Komi Republic	25.3	North-West
	Kurgan Region	25.6	Ural
	Leningrad Region	26.0	North-West
	Ingushetia Republic	26.2	North Caucasian
	Tula Region	26.4	Central
	Chuvash Republic	26.4	Privolzhsky
	Kamchatka Territory	27.7	Far Eastern
	Jewish autonomous Region	28.6	Far Eastern
	Sakhalin Region	36.2	Far Eastern
The number of students per teacher working in HEIs	**With minimum values of indicators**		
	Crimea Republic	13.7	South
	Karelia Republic	14.6	North-West
	Saint Petersburg City	14.7	North-West
	Krasnoyarsk Territory	14.8	Siberia
	North Ossetia-Alania Republic	15.2	North Caucasian
	Tver Region	15.4	Central
	Primorsky Territory	15.5	Far Eastern
	Sakha Republic	15.5	Far Eastern
	Moscow City	15.5	Central
	Ivanovo Region	15.7	Central
	Tomsk Region	15.8	Siberia
	Altai Republic	16.0	Siberia
	Buryatia Republic	16.1	Far Eastern

Table 4 provides information on the values of indicators for each region and their territorial location. The analysis of this information showed that there is no connection between the maximum and minimum values of the indicators and the territorial location of the regions. That is, the regions with high and low values of indicators are located in different federal districts. Thus, we can confirm hypothesis 3.

Conclusion

In general, our research makes several important contributions to the knowledge of the territorial features of the development of higher education in Russia. First, it was found that teachers worked in 2020 in HEIs that were located in all 82 regions of Russia without exception. Accordingly, residents of each region could study in an accessible proximity to their place of residence. During the study, a method was proposed for evaluating four indicators that characterize the activity of teachers in HEIs using the density functions of the normal distribution. Based on the proposed methodology, the distribution of the corresponding indicators was estimated for all 82 regions of Russia. The results of the computational experiment showed that, on average, there was slightly more than two teachers working in HEIs per thousand working-age residents in the regions. We demonstrated that on average the number of teachers per HEI in the region is 158. It is proved that on average the proportion

of teachers who have a DSc and PhD degree in the number of teachers is almost 75%. In universities and HEIs, on average, the number of students per teacher is more than 20.

The analysis showed that there was significant differentiation of the values of two indicators by region: the number of teachers working in HEIs per thousand working-age residents in the region and the average number of teachers per HEI in the region. The regions that were characterized by the maximum and minimum values of the four considered indicators were identified. The study showed that the territorial location of the regions does not significantly affect the maximum and minimum values of the indicators.

The practical significance of the study for the government is that they now can consider the territorial features in the development of higher education in the regions of Russia. The results of the work can be used in the activities of federal and regional structures related to the support of educational processes, for justifying their planned activities and improving the quality of higher education by increasing the share of highly qualified teachers. For potential students, data on the distribution of teaching staff by region may be of particular interest. The new knowledge gained is of interest and can be used in the educational process at universities.

The study had no limits on empirical data because it was based on official statistical information of all 82 regions of Russia. Further research may be aimed at establishing gender characteristics and describing the number of teachers in HEIs in Russia.

References

Abel, J., & Deitz, R. (2011). Do colleges and universities increase their region's human capital? *Journal of Economic Geography*, *12*(3), 667-691. https://doi.org/10.1093/jeg/lbr020

Afeez, B., Maxwell, O., Otekunrin, O., & Happiness, O. (2018). Selection and Validation of Comparative Study of Normality Test. *American Journal of Mathematics and Statistics*, *8*(6), 190-201.

Anisimova, E., & Babich, S. (2016). Study of the main trends in the field of higher education. *Economics and Management in the XXI Century: Development Trends*, (33-2), 154-158.

Cervantes, M. (2017). Higher education institutions in the knowledge triangle. *Foresight and STI Governance*, *11*(2), 27-42. https://doi.org/10.17323/2500-2597.2017.2.27.42

Ciriaci, D. (2014). Does university quality influence the interregional mobility of students and graduates? The case of Italy. *Regional Studies*, *48*(10), 1592-1608. https://doi.org/10.1080/00343404.2013.821569

Cour des Comptes. (2019). *La mobilité internationale des étudiants : S'organiser pour les défis à venir.* https://www.vie-publique.fr/sites/default/files/rapport/pdf/194000726.pdf

Douglass, J. (2011). Higher education's new global order: How and why governments are creating structured opportunity markets. *Educational Studies Moscow*, (1), 73-98. https://doi.org/10.17323/1814-9545-2011-1-73-98

Federal State Statistics Service. (2021). https://gks.ru/bgd/regl/B19_16/Main.htm

Guri-Rosenblit, S., Sebkova, H., & Teichler, U. (2007). Massification and diversity of higher education systems: interplay of complex dimensions. *Higher Education Policy*, *20*(4), 373-389. https://doi.org/10.1057/palgrave.hep.8300158

Jaspers, K. (1960). *The Idea of the University*. Beacon Press.

Kirillina, Y. (2015). Quality in higher education in quantitative indicators. *Problems and Prospects of Education Development in Russia*, (33), 132-136.

Kurilova, O. (2020). Features of changes in the number and structure of university teachers. *Regional Bulletin*, *17*(56), 48-49.

Lomonosov, A. (2013). Definition of students' number standards for one staff position of the teaching staff. *Creative Economy*, *12*(84), 102-111.

Maksimova, I. (2019). Prospects for increasing the competitiveness of higher education in Russia. *Scientific Bulletin of the Volgograd Branch of the RANEPA*, (2), 81-93.

Melikyan, A. (2021). Statistical analysis of the dynamics of performance indicators of Russian universities. *Questions of Statistics*, *28*(1), 38-49. https://doi.org/10.34023/2313-6383-2021-28-1-38-49

Ministry of Science and Higher Education of the Russian Federation. (2021). *Official statistical information on additional professional and higher education*. https://minobrnauki.gov.ru/action/stat/highed/

OECD. (2019). *Education at a Glance 2019: OECD Indicators*. OECD Publishing. https://doi.org/10.1787/f8d7880d-en.

Pinkovetskaia, I., & Slepova, V. (2018). Estimation of Fixed Capital Investment in SMEs: the Existing Differentiation in the Russian Federation. *Business Systems Research*, *9*(1), 65-78. https://doi.org/10.2478/bsrj-2018-0006

Pinkovetskaia, I., Lebedev, A., Slugina, O., Arbeláez, D, & Rojas, M. (2021). Informal Personal Financing of Entrepreneurs: Gender Characteristics. *Universal Journal of Accounting and Finance*, *9*(3), 442-449. https://doi.org/10.13189/ujaf.2021.090319

Popova, S., & Vdovina, E. (2017). Specificity of higher professional education in the Penza region. *Bulletin of Penza State University*, *4*(20), 8-11.

Rahman, M., & Wu, H. (2013). Tests for normality: A comparative study. *Far East Journal of Mathematical Sciences*, *75*(1), 143-164.

Razali, N., & Yap, B. (2011). Power comparisons of Shapiro-Wilk, Kolmogorov-Smirnov, Lilliefors and Anderson-Darling tests. *Journal of Statistical Modeling and Analytics*, *2*(1), 21-33.

Romanov, E. (2018). Threats to the personnel potential of regional universities. *Economy of the region*, *14*(1), 95-108. https://doi.org/10.17059/2018-1-8

Seier, E., & Bonett, D. (2002). A test of Normality with high uniform power. *Computational Statistics & Data Analysis*, (40), 435-445.

Stiglitz, J. (2014). *Creating a Learning Society: A New Approach to Growth, Development, and Social Progress*. Columbia University Press.

Unger, M., & Polt, W. (2017). The knowledge triangle between research, education and innovation – A conceptual discussion. *Foresight-Russia*, (2), 10-26. https://doi.org/10.17323/2500-2597.2017.2.10.26

Vadimova, I. (2015). Transition to new relations number of teachers and students. *Counselor in the field of education*, (6), 14-18.

Vardanyan, G., & Keshishyan, G. (2020). Comparative statistical analysis of the dynamics number and structure of the professor-teaching staff of higher educational institutions of the RF and RA for

the past decade. In *The collection: Technologies in education - 2020. Collection of materials of the International Scientific and Methodological Conference. Novosibirsk* (pp. 384-393).

Vlasova, O. (2021). The influence of transformation processes in the higher education system on the number of its staff. *Baltic Humanitarian Journal*, *1*(34), 59-62. https://doi.org/10.26140/bgz3-2021-1001-0013

Yap, B, & Sim, C. (2011). Comparisons of various types of normality tests. *Journal of Statistical Computation and Simulation*, *81*(12), 2141-2155.

Yazici, B., & Asma, S. (2007). A comparison of various tests of normality. *Journal of Statistical Computation and Simulation*, *77*(2), 175-183.