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Differences in the Intelligence of 15 Year Olds in 42 Provinces and Cities of the Russian Federation and Their Economic, Social and Geographical Correlates

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This study reports data for the intelligence of 15 year olds in 42 provinces and cities of the Russian Federation assessed in the 2015 Programme for International Student Assessment (PISA) and their economic, social and geographical correlates. It was found that the average PISA scores of the provinces and cities were significantly correlated with the scores on the Unified State Examination in 2014 (r = .53, p<.001) reported by Grigoriev et al. (2016), with literacy rates in 1897 (r = .50, p<.01), with the percentage of ethnic Russians in the population, and with latitude and longitude showing that PISA scores were higher in the more northerly and westerly provinces.
Key Words: PISA 2015; Russia; Russian regions; Per capita income; Latitude; Longitude; Ethnicity.

There have been a number of studies of regional differences in intelligence within countries and their social, economic, demographic and epidemiological correlates. These include positive associations with per capita income, educational attainment, life expectancy and stature, and negative associations

with infant mortality and fertility. The first of these studies was reported for the United States by Davenport and Remmers (1950), who gave a correlation of .32 between state IQ and per capita income. Later studies reported similar associations for the regions of the British Isles (Lynn,1979), France (Lynn, 1980; Kirkegaard, 2015), the United States (McDaniel, 2006; Shatz, 2009), Italy (Lynn, 2010; Piffer & Lynn, 2014), Portugal (Almeida, Lemos & Lynn, 2011), Germany (Roivainen, 2012), Spain (Lynn, 2012), China (Lynn & Cheng, 2013; Lynn, Cheng & Wang, 2016), Japan (Kura, 2013), Finland (Dutton & Lynn, 2014), India (Lynn & Yadav, 2015), Turkey (Lynn, Sakar & Cheng, 2015), the United Kingdom (Carl, 2015) and Brazil (Lynn, Antonelli-Ponti, Mazzei & Da Silva, 2017).

There have been two studies of regional differences in intelligence and their economic and social correlates in Russia. In the first of these, Grigoriev, Lapteva and Lynn (2009) reported data for European Russia in the late nineteenth century. Differences in intelligence for 50 provinces were inferred from the literacy rates and were shown to be significantly negatively associated with infant mortality (r = -.28), fertility (r = -.75) and longitude (r = -.43) showing that IQs were higher in the more westerly provinces, and significantly positively associated with stature (r = .56) and latitude (r = .33) showing that IQs were higher in the more northerly provinces.

In the second study, Grigoriev et al. (2016) reported data for differences in educational attainment (educational quotient, EQ) as a proxy for intelligence, a number of socio-economic variables, and latitude and longitude for 79 provinces of the Russian Federation. The average intelligence of the provinces was significantly positively correlated with urbanization (r = .43), the percentage of ethnic Russians (r = .39), net migration (r = .54) and latitude (r = .35), such that intelligence was higher in the North, and significantly negatively correlated with infant mortality (r = -.43), fertility (r = -.39) and longitude (r = -.36), such that intelligence was higher in the West. In the present paper we report a further study of differences in intelligence across provinces and cities in the Russian Federation and their social and economic correlates.

Method

There are 83 provinces in the Russian Federation. Data for 40 provinces of these and two cities (Moscow City and St. Petersburg City) are given for 6,036 students aged 15 who participated in the Programme for International Student Assessment (PISA) in 2015 in tests of Reading, Math, and Science. The PISA scores have been adopted as measures of regional IQs in studies in Turkey (Lynn, Sakar & Cheng, 2015) and Brazil (Lynn, Antonelli-Ponti, Mazzei & Da Silva (2017). This usage is justified because the PISA tests are constructed to measure

cognitive ability rather than knowledge of the curriculum and by the finding that across 108 national populations PISA scores are correlated with IQs at r = .91 (Lynn & Meisenberg, 2010).

Differences in intelligence reported for the Russian provinces by Grigoriev et al. (2016) are included in the analyses to ascertain how far they are consistent with the PISA scores. We also examined the relationship of the PISA scores with contemporary educational attainment in the regions of the Russian Federation, and literacy rates of the corresponding regions of the former Russian Empire in the late nineteenth century. The administrative map of the contemporary Russian Federation differs from that of the former Russian Empire. To ensure an approximate correspondence between the two sets of regions, we used the following procedure: The provinces of the Russian Empire were divided into smaller divisions (*uyezds*). Data for literacy in the *uyezds* are available in the Russian 1897 census (Первая всеобщая перепись населения Российской Империи 1897, 1899-1905). We assume that if the main town of a given *uyezd* is on the territory of a contemporary region, then the whole *uyezd* is in this region. Thus the contemporary regions are regarded as consisting of former *uyezds*, which may belong to several former provinces. The literacy rates of populations in the territories of the contemporary regions in the late nineteenth century were calculated as weighted means of the rates for former *uyezds* whose main towns are in the territories of the contemporary regions. There were no main towns in the former *uyezds* in the territory of Yamalo-Nenets autonomous district, and the literacy rate for this district was estimated from the literacy rate for the *uyezd* in Tobolsk province that is now the greatest part of this district.

The data for per capita income were measured as GDP (gross domestic product) per capita based on the UN figures in the year 2009 (UNDP, 2011). The percentage of Russian ethnicity was taken from the 2010 All-Russian Population Census published by the Russian Federal State Statistics Service (2011).

Results

Table 1 gives the means and standard deviations of the PISA total scores, the educational attainment quotients (EQ) given by Grigoriev et al. (2016), literacy rates in 1897, GDP per capita, latitude, longitude, and the percentage of ethnic Russians. The PISA scores on Reading, Math and Science were highly intercorrelated: Reading x Math: 0.83; Reading x Science: 0.91; Math x Science: 0.92. The scores are therefore averaged for the correlations shown in Table 2.

A multiple regression analysis using the PISA scores as the dependent variable and the other measures as the independent variables showed that latitude (β = .34, t = 2.29, p<.05), longitude (β = -.29, t = 2.23, p<.05) and the

percentage of Russian ethnicity (β = .36, t = 2.68, p<.01) were the significant predictors of the PISA scores, accounting for 41% of total variance.

Table 1. *Provincial and city differences in PISA 2015, the state examination scores (EQ) in 2014, the retrieved literacy rates in 1897, and other variables in Russia.*[1]

Region	PISA Score Mean ± SD	EQ	Lit	GDP	% Russian	Lat.	Long.	N
Rep. of Bashkortostan	469.0 ± 75.9	99	16.0	15,797	36.1	54.3	56.2	183
Rep. of Dagestan	424.1 ± 71.0	84	10.6	9,337	3.6	43.1	46.5	135
Kabardino-Balkarian Rep.	454.0 ± 59.4	82	5.0	7,666	22.5	43.4	43.2	111
Rep. of Sakha (Yakutia)	469.1 ± 65.0	96	4.1	21,159	37.8	66.2	129.1	96
Rep. of Tatarstan	487.5 ± 65.4	104	18.9	23,290	39.7	55.5	49.1	129
Chuvashi Rep.	505.0 ± 60.5	101	12.3	10,971	26.9	55.3	47.1	93
Altai territory	493.1 ± 78.2	101	8.8	7,520	94.0	52.5	83.8	98
Krasnodar territory	467.8 ± 71.3	105	18.1	13,899	88.3	45.2	39.1	173
Krasnoyarsk territory	496.9 ± 78.2	98	13.9	20,779	91.3	59.6	83.2	168
Primorsky territory	491.4 ± 74.9	96	29.5	12,574	92.5	45.2	131.9	123
Stavropol territory	454.3 ± 57.0	97	16.4	8,725	80.9	45.1	41.9	130
Arkhangelsk region	501.4 ± 64.0	103	21.6	19,310	95.6	63.3	40.3	129
Belgorod region	482.2 ± 68.1	100	15.9	19,569	94.4	50.5	36.7	120
Vladimir region	469.5 ± 70.8	98	26.4	11,666	95.6	56.1	40.4	142
Volgograd region	471.8 ± 68.1	96	25.5	13,200	90.0	48.4	44.5	103
Voronezh region	500.0 ± 69.0	100	16.6	11,036	95.5	51.1	40.1	81
Ivanovo region	509.1 ± 64.5	97	26.8	7,425	95.6	57.1	41.1	154
Irkutsk region	452.8 ± 74.6	93	15.2	15,987	88.5	57.2	106.0	175
Kaliningrad region	518.8 ± 61.8	103	-	14,136	86.4	54.5	21.1	150
Kamchatka territory	482.2 ± 62.0	86	12.1	12,931	85.9	56.0	159.0	109
Kemerovo region	460.4 ± 60.1	99	8.8	18,721	93.7	54.6	87.1	103
Kostroma region	522.1 ± 66.6	96	26.7	10,941	96.6	58.3	43.4	115

Region	PISA Score Mean ± SD	EQ	Lit	GDP	% Russian	Lat.	Long.	N
Lipetzk region	523.7 ± 68.2	93	16.7	17,902	96.3	52.4	39.6	86
Moscow region	511.3 ± 71.4	110	27.0	17,255	91.6	55.5	38.2	286
Nizhni Novgorod region	502.2 ± 64.8	104	20.3	14,709	95.1	56.3	44.3	169
Novgorod region	476.7 ± 68.2	97	23.6	16,397	95.1	58.3	32.2	89
Novosibirsk region	485.3 ± 74.8	106	9.4	13,383	93.1	55.3	79.3	112
Omsk region	493.9 ± 65.7	98	12.3	16,213	85.8	56.1	73.1	120
Orenburg region	503.1 ± 71.7	100	18.0	19,507	75.9	51.5	55.1	86
Perm territory	498.6 ± 81.0	105	18.5	16,642	87.1	59.1	56.3	189
Rostov region	464.4 ± 76.7	98	23.0	11,302	90.3	47.5	41.1	206
Ryazan region	496.6 ± 68.7	102	18.8	11,510	95.1	54.2	40.4	113
Samara region	488.8 ± 69.5	101	19.8	14,520	85.6	53.3	50.3	191
Saratov region	509.5 ± 72.9	99	26.1	12,812	90.0	51.5	46.4	109
Sverdlovsk region	495.4 ± 75.4	106	20.6	15,811	90.6	58.4	61.2	232
Tomsk region	480.6 ± 72.6	108	19.3	19,064	92.1	58.5	82.1	79
Ulyanovsk region	500.5 ± 62.4	97	17.6	11,794	73.6	53.5	47.6	116
Chelyabinsk region	500.7 ± 69.9	98	19.2	15,098	83.8	54.3	60.2	206
Moscow City	516.4 ± 72.8	110	53.1	40,805	91.7	55.5	38.2	373
St. Petersburg City	524.4 ± 71.1	111	61.6	25,277	84.7	59.6	30.3	245
Khanty-Mansijsk autonomous district - Yugra	480.3 ± 64.7	94	8.6	-	98.1	62.2	70.1	119
Yamalo-Nenets autonomous district	481.6 ± 75.4	-	8.4	-	61.7	66.7	66.5	90
Russian Federation	**491.8 ± 73.2**	**99.1**	**19.3**	**18,869**	**81.0**	**51.5**	**58.7**	**6,036**

[1] Observations (N) were unweighted, means were weighted with Senate Weight (country weight). EQ = Educational quotients, the Unified State Examination in 2014 from Grigoriev et al. (2016). Lit = % Literacy 1897, from Тройницкий (1899-1905). GDP = per capita gross domestic product, from UNDP (2011), based on the UN figures in the year 2009. %Russian = Russian ethnicity, from Russian Federal State Statistics Service (2011). Lat = latitude; Long = longitude.

Table 2. *Mean ± standard deviation and correlation matrix for variables shown in Table 1. *p<.05; **p<.01; ***p<.001.*

	Mean ± SD	Lat.	Long.	PISA	EQ	Lit.	GDP
Longitude	58.65 ± 29.18	.16					
PISA	491.8 ± 73.2	.35*	-.25				
EQ	99.05 ± 6.69	.36*	-.31	.53***			
Literacy	0.19 ± 0.11	.02	-.37*	.50**	.52**		
GDP	4.17 ± 0.15	.47**	.07	.31	.55***	.41**	
%Russian	79.08 ± 23.47	.11	-.04	.45**	.43**	.36*	.17

Discussion

There are six points of interest in the study. First, the PISA scores were significantly correlated (r = .53, p<.001) with the educational quotients (EQs) of the provinces estimated from educational achievement tests given by Grigoriev et al. (2016) and with the literacy rates in 1897 (r = .50, p<.01) showing a significant degree of consistency between the three measures. This consistency is remarkable considering the smallish sample sizes for PISA in individual provinces and the limited range of variation among the provinces. Note in particular that the province of Dagestan has the lowest PISA score (424.1) and the second lowest EQ (84); and also that the city of St. Petersburg has the highest PISA score (524.4), the highest EQ (111) and the highest literacy rate in 1897 (61.6%). The city of Moscow has the fourth highest PISA score (516.4), the second highest EQ (110) and the second highest literacy rate in 1897 (53.1%). These high results for St. Petersburg (the former capital city) and Moscow (the present capital city) are consistent with several studies reporting that the populations of capital cities have higher IQs than the rest of the population, e.g. in the British Isles and France (Lynn, 1979; 1980) and in Portugal (Almeida et al., 2011). The likely explanation for this is that there is a tendency for those with higher than average intelligence to migrate from the provinces to capital cities, establish families there and transmit their high intelligence to later generations.

Second, the PISA scores were correlated at r = .31 with GDP per capita. The correlation falls just short of statistical significance at p<.05 (r = .32 would be statistically significant). GDP per capita was also significantly correlated at .55 (p<.001) with the EQs of the provinces and cities given by Grigoriev et al. (2016) and with the literacy rates in 1897 (r = .41, p<.01) providing further confirmation of this association. Taken together, these results are consistent with a number of previous studies reporting positive associations of regional IQs with per capita

income cited in the introduction.

Third, the PISA scores were significantly correlated at $r = .45$ ($p<.01$) with the percentage of the population with Russian ethnicity. This result is confirmed by the multiple regression analysis showing that the percentage of Russian ethnicity was a significant predictor of the PISA scores ($\beta = .36$, $t = 2.68$, $p<.01$). This result is closely similar to the .39 EQ correlation obtained by Grigoriev et al. (2016). Note in particular that the province of Dagestan has the lowest percentage with Russian ethnicity (3.6 percent), the lowest PISA score (424.1) and the second lowest EQ (84). Studies of the intelligence of the ethnic minorities in Russia have reported varying results. In the province of Yakutia the Yakuts obtained approximately the same IQ as the ethnic Russians with British IQs of 97.0 and 97.9, respectively (Shibaev & Lynn, 2017). However, a sample of ethnic Evenk/Tungus of the Russian Far East obtained a British IQ of only 80 (Shibaev & Lynn, 2015).

Fourth, the PISA scores were significantly correlated at $r = .35$ ($p<.05$) with latitude showing that IQs are higher in the more northerly provinces. This result is confirmed by the multiple regression analysis showing that latitude was a significant predictor of the PISA scores ($\beta = .34$, $t = 2.29$, $p<.05$). This result confirms that obtained in the late nineteenth century in which intelligence was found to be higher in the North than in the South ($r = .33$, $p<.05$) reported by Grigoriev, Lapteva and Lynn (2009). These correlations are virtually the same as the .35 correlation obtained for 79 Russian provinces reported by Grigoriev et al. (2016) and confirmed at .36 in Table 2 for the 40 provinces and two cities in the present study. Note in particular that the most southerly province of Dagestan has the lowest PISA score (424.1) and the second lowest EQ (84). These results corroborate the 'cold winters theory' of the evolution of racial differences in intelligence advanced in Lynn (1991, 2015) that proposes that greater cognitive demands for survival in the temperate and cold environments of the northern hemisphere provided a selection pressure for the evolution of higher intelligence. This theory has been corroborated by a number of studies that have reported statistically significant associations between average cold winter temperatures and national IQ (Kanazawa, 2008; Meisenberg & Woodley, 2013; Rushton, 2000; Templer & Arikawa, 2006).

Fifth, the PISA scores were negatively correlated at $r = -.25$ with longitude showing that IQs tended to be higher in the more westerly provinces. This correlation is not statistically significant but the multiple regression analysis showed that longitude was a significant predictor of the PISA scores ($\beta = -.29$, $t = 2.23$, $p<.05$). This result is in the same direction as the negative correlation of longitude with EQ (-.31, ns) and with literacy in 1897 ($r = -.37$, $p<.015$). Note in

particular that the most westerly province of Kaliningrad has the third highest PISA score (518.8) and the tenth highest EQ (103). These results taken together show that there is a significant tendency for IQs to be higher in the West of the Russian Federation.

Sixth, the PISA results give scores for one province for which no data are given by Grigoriev et al. (2016). This is the north central province of the Yamalo-Nenets autonomous district which has a below average score of 481.6. Part of the explanation for this low score may be that the percentage of ethnic Russians is relatively low at 61.7 as compared with 79 percent for the whole of the Russian Federation. Another part of the explanation may be its remote Arctic location.

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