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The influence of pre-university education resources on school dropout and the unemployment rate in Romania is significant?

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Abstract In Romania, especially at county level, school dropout rate in primary and secondary education, school dropout rate in high school and professional education, as well as unemployment rate, differ significantly from one county to another, the values being in some cases quite increase. Starting from these findings, the paper predicts the results of the comparative analysis of the evolution and transformations recorded by the educational infrastructure, and students per teacher in pre-university education, parallel to the school dropout rate and unemployment rate in 2022 versus 2012. The obtained results highlight the fact that the educational infrastructure and students per teacher in pre-university education do not have a significant influence on the school dropout rate and unemployment rate, the decrease being mainly the result of the standard of living and economic and social development at the local and county level.
.**Keywords:** *education, education infrastructure, school dropout, unemployment, GDP*

1. Introduction

The need and, at the same time, the challenges of sustainable development require the formation of a population with the highest possible educational level, which will not only contribute to the achievement of this desired goal, but also understand what such an objective entails. In this process, the school is a foundation of human development, a tool against poverty and arming the population with knowledge regarding social development and progress [Urean, 2017], as well as the easiest possible adaptation to technological changes in the new educational context [Stroe, 2022]. Education for sustainable development is also a factor that leads to increasing the capacity of individuals and communities to think and act in favor of sustainable development, to explore and develop new concepts and visions [Andritoiu, 2019].

Both at the level of the European Union and in Romania, education are a major objective. The educational process, and especially its results, is influenced by economic, social and cultural factors [Olah, 2019], by the attitude of the population towards education, specific to local and regional communities, there are still significant urban-rural differences regarding the point of view regarding the minimum level of school education that does not lead to a decrease in the chances of integration into society [Munteanu, 2022].

Leaving education early, as well as school dropout, are phenomena that negatively influence the process of sustainable development [Preda & Toma, 2020], which contemporary society faces, not

only in Romania, but also in the entire European space [Gorghiu et.al, 2021]. Among the factors that contribute to the existence of these negative phenomena are the value systems of the young generation, their dynamics, determined by significant changes in the external environment or internal motivations [Pelin et.al. 2022], parents' negligence and attitude towards education, correlated with the weak involvement of the careless teacher [Jafer et.al., 2021], family financial situation, travel time to school [Petre et.al., 2024], as well as the way how children understand school dropout [Tarusha & Bilali, 2015]. Finally, like a vicious circle, school dropout is the main cause of unemployment, social exclusion, poverty and poor health [Gherasim, 2022]**.**

Of course, reducing the number of people who leave the educational system prematurely, as well as school dropouts, are important concerns for national governments and international organizations [Alexa & Baciu, 2021]. At the Romanian level, there are continuous attempts to modernize the education process, annual social programs are carried out in order to support students from disadvantaged areas and, to ensure equal opportunities for education for students from high-risk groups [Andrițoiu, 2019]. Unfortunately, the frequency and amplitude of the annual modifications regarding the pre-university education system in Romania sometimes lead to students' confusion, which leads to a reduction in their efficiency.

Starting from these aspects, the research carried out aimed to identify the way in which the interdependencies between the resources of the pre-university education process at the level of the counties in Romania and school dropout rate in primary and secondary education, school dropout in high school and professional education, the unemployment rate and the gross domestic product have evolved in the period 2012 - 2022.

The paper presents the results obtained in two clusters analyzes carried out for the years 2012 and 2022. We emphasize that in the paper the resources of the pre-university educational process are aimed at the educational infrastructure (students per classroom, students per laboratory, students per workroom and students per PC), and the teaching staff (Students per teacher), the parameters that aim at the quantitative aspect, and not the quality of the educational act.

The results obtained are compared with those of the study Education and employment rate in Romania [Ciumas et.al., 2017], which is also a cluster analysis at county level targeting the registered population, the employment rate, gross domestic product, classrooms, classroom teachers, school workshop and educational units.

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2. Data series and methodology

The current study utilizes primary data sourced from the National Institute of Statistics of Romania, statistical database of the years 2012 and 2022 regarding pre-university education, at the level of Romanian counties regarding the school population, by education levels, [SPEL, 2024], Teaching staff [TSEL, 2024], classrooms (school offices/amphitheatres) [CREL, 2024], school laboratories [SPEL, 2024], school workshops [SWEL, 2024], PC/IT equipment [PCIT, 2024], dropout rate in pre-university education [DRPE, 2024], as well as the unemployment rate [URDR, 2024] and the BIM unemployment rate by age groups and development regions [AMG, 2024]. Also, data from EUROSTAT were used regarding the gross domestic product per inhabitant [GDP, 2024], in the years 2012 and 2021 (the last year with available data).

The identifiers and significance of the variables used in the analyses are provided in Table 1.

In order to highlight and characterize, on the one hand, the structuring of the counties in clusters with similar characteristics, and on the other hand, to capture the changes that occurred within the counties regarding the resources of pre-university education compared to the school dropout rate and the unemployment rate, in an interval of ten years, two cluster analysis were carried out, one at the level of 2012, and the second, at the level of 2022.

Cluster generation was performed using the hierarchical cluster methodology, with squared Euclidean distance for the generation of the Proximity matrix and Ward's method for generating the clusters.

The testing of the statistical significance of the mean values of the variables at the clusters level was performed with the ANOVA methodology, as well as the Welch and Brown-Forsythe tests (Robust Tests of Equality of Means).

Table1 The identifiers and meanings of the variables used in the analyzes performed

Variable	Sinification	Units
STPUEx	Students per teacher in pre-university education	persons
SCPUEx	Students per classroom in pre-university education	persons
SLPUEx	Students per laboratory in pre-university education	persons
SWPUEx	Students per workroom in pre-university education	persons
SPCPUEx	Students per PC in pre-university education	persons
SDRPSEx	School dropout rate in primary and secondary education	%
SDRHPEx	School dropout rate in high school and professional education	%
UEPRx	Unemployment rate	%
GDPx	Gross Domestic Product	euro/inhabitant

Note: year 2012 x=12; year 2021 x=21; year 2022 x=22

Given that the application of the ANOVA methodology assumes the homogeneity of the dispersions of the data series, in a first phase, the Levene test (Test of Homogeneity of Variance) with the following hypotheses was used:

H_{01}: there is no significant difference between dispersions of data series.

$$\exists\, \sigma_i^2 = \sigma_j^2, \quad i = \overline{1,r},\ j = \overline{1,r}, i \neq j \tag{1}$$

$H_{11:}$ the dispersions of the data series differ significantly.

$$\sigma_i^2 \neq \sigma_j^2, \quad \forall\, i = \overline{1,r},\ j = \overline{1,r}, i \neq j \tag{2}$$

The condition for accepting the null hypothesis (H_{01}) is: Sig.> α. If the null hypothesis (1) is accepted, then for testing the statistical significance of the averages recorded at the cluster level, the ANOVA methodology with the hypotheses can be used:

H_{02}: there is no significant difference between the means of the data series.

$$\exists\, m_i = m_j, \quad i = \overline{1,r},\ j = \overline{1,r}, i \neq j \tag{3}$$

$H_{12:}$ the means of the data series differ significantly.

$$m_i = m_j, \quad \forall\, i = \overline{1,r},\ j = \overline{1,r}, i \neq j \tag{4}$$

If the null hypothesis H_{01} is rejected and the alternative hypothesis H_{11} is accepted, instead of the ANOVA methodology, Welch and Brown-Forsythe tests (Robust Tests of Equality of Means) were used, with assumptions similar to those used in the ANOVA methodology (relations 3 and 4). The rejection of the null hypothesis H_{02} and the acceptance of the alternative hypothesis H_{12} mean that the averages of the data series, recorded at the cluster level, are statistically significant and provide a good description of the characteristics of the respective clusters.

A confidence level of 95%, corresponding to a significance threshold of α=0.05, was used to test the statistical hypotheses. Data processing was performed using SPSS.

3. Results and Discussion

In a first analysis of the data series, both at the level of 2012 and at the level of 2022, due to particularities, two administrative entities, Ilfov County and Bucutresti Municipality, were not included in the cluster analyses. Their characteristics were analyzed separately, but compared to the characteristics of the resulting clusters at the level of each year. Also, the SWPUE variable was not

introduced in the cluster analyses, as it has very high values in counties such as Giurgiu and Teleorman compared to the other counties, which would have affected the results obtained.

At the level of 2012, following analyzes carried out regarding the statistical significance of the results obtained, a structuring of the 40 counties included in the analysis into eight clusters resulted (Table 2). Cluster A12 includes eight counties, clusters B12 and F12 include five counties each, cluster C12 includes seven counties, cluster D12 includes four counties, cluster E12 includes seven counties, cluster G12 includes two counties, and cluster H12 includes three counties.

Table 2 Cluster structure regarding pre-university education resources, school dropout and unemployment rate in 2012

Cluster	Counties included in the cluster
A12	Arges, Bihor, Cluj, Dambovița, Hunedoara, Gorj, Olt, Valcea
B12	Bistrita-Nasaud, Maramureş, Mures, Satu Mare, Neamt
C12	Alba, Caraş-Severin, Covasna, Harghita, Salaj, Tulcea
D12	Arad, Brasov, Sibiu, Timis
E12	Bacau, Botosani, Brăila, Buzau, Ialomita, Iasi, Vrancea
F12	Calarasi, Giurgiu, Galati, Suceava, Vaslui
G12	Constanţa, Prahova
H12	Dolj, Mehedinti, Teleorman

In order to test the statistical significance of the average values recorded at the cluster level, in a first phase, the homogeneity of the dispersions of the data series was checked. For this purpose, Levene's test was used. The results obtained (Table 3) highlight the fact that all the values $Sig. > \alpha = 0.05$, which leads to the acceptance of the null hypothesis H_{01}, the dispersions of the data series are homogeneous and, consequently, to test the statistical significance of the average values recorded at the cluster level, the ANOVA methodology can be applied

Table 3 The results of the Test of Homogeneity of Variance corresponding to 2012

Variables	Levene Statistic	df1	df2	Sig.
STPUE12	0.610	7	32	0.744
SCPUE12	1.874	7	32	0.107
SLPUE12	1.667	7	32	0.153
SPCPUE12	0.552	7	32	0.789
SDRPSE12	0.960	7	32	0.476
SDRHPE12	0.922	7	32	0.503
UEPR12	1.989	7	32	0.088
GDP12	1.397	7	32	0.241

Source: Prepared by the authors using SPSS

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Following the use of the ANOVA methodology, the results obtained (Table 4) highlight the fact that all the values of the statistic $F > F_{0.05,7,32} = 2.26$, as well as of $Sig. < \alpha = 0.05$, leads to the rejection of the null hypothesis H_{02} and the acceptance of the alternative hypothesis H_{12}. In conclusion, the average values of the variables, recorded at the clusters level, are statistically significant.

At the level of 2012, from the point of view of the infrastructure of the educational process in pre-university education, as well as the number of students per teacher, the best results were recorded in clusters C12, B12, D12 and A12, with values of STPUE12, SCPUE12 and SPCPUE12 below average at the level of Romania (14.73 students per teacher, 24.39 students per classroom and 11.707 students per PC). So, the cluster C12, formed by Alba, Caras-Severin, Covasna, Harghita, Salaj and Tulcea counties, is characterized by the lowest values of STPUE12, 13.12 students per teacher (with 11.0% below average), of SCPUE12, 20.50 students per classroom (with 15.9% below average), SLPUE12,

133.12 students per laboratory (18.3% below average) and of SPCPUE12, 9.60 students per PC (13.3% below average).

Table 4 Results of the ANOVA application corresponding to the year 2012

Variables	Sum of Squares		df1	df2	F	Sig.
	Between Groups	Within Groups				
STPUE12	26.808	15.276	7	32	8.022	0.000
SCPUE12	376.078	158.798	7	32	10.826	0.000
SLPUE12	18643.806	14411.478	7	32	5.914	0.000
SPCPUE12	40.020	29.100	7	32	6.287	0.000
SDRPSE12	7.877	7.222	7	32	4.986	0.001
SDRHPE12	32.714	22.356	7	32	6.690	0.000
UEPR12	77.139	55.657	7	32	6.336	0.000
GDP12	70022214.286	27976785.714	7	32	11.442	0.000

Source: Prepared by the authors using SPSS

The characteristics of the clusters, according to the eight variables corresponding to the year 2012 included in the analysis, are presented in table 5.

Table 5 The main characteristics of the clusters, corresponding to the year 2012

Cluster	Parameter	Characteristics of clusters							
		STPUE1	SCPUE1	SLPUE1	SPCPUE1	SDRPSE1	SDRHPE1	UEPR1	GDP12
A12	Mean	14.13	23.66	157.2	10.74	0.76	1.69	6.21	6075
	Std. Dev.	0.91	2.25	20.68	1.16	0.55	0.91	1.52	1418
	Std. Error	0.32	0.80	7.31	0.41	0.20	0.32	0.54	501
B12	Mean	14.30	20.72	171.3	10.02	1.44	4.54	5.02	4960
	Std. Dev.	0.65	1.41	16.97	0.47	0.39	0.69	0.72	586
	Std. Error	0.29	0.63	7.59	0.21	0.17	0.31	0.32	262
C12	Mean	13.12	20.50	133.1	9.60	1.38	3.23	6.82	5450
	Std. Dev.	0.72	2.72	23.96	1.15	0.26	0.57	1.12	807
	Std. Error	0.29	1.11	9.78	0.47	0.11	0.23	0.46	329
D12	Mean	14.43	21.88	143.4	10.70	2.18	3.83	3.75	8175
	Std. Dev.	0.28	2.00	15.13	0.69	0.63	1.11	1.29	950
	Std. Error	0.14	1.00	7.57	0.35	0.31	0.56	0.64	475
E12	Mean	15.45	25.50	181.6	11.03	1.94	3.37	6.21	4571
	Std. Dev.	0.59	1.20	24.46	0.94	0.50	0.59	1.30	621
	Std. Error	0.22	0.45	9.24	0.36	0.19	0.22	0.49	234
F12	Mean	15.44	28.24	201.7	12.94	1.36	2.38	7.52	3880
	Std. Dev.	0.66	3.46	26.74	0.81	0.39	0.71	1.96	679
	Std. Error	0.30	1.55	11.96	0.36	0.17	0.32	0.88	303
G12	Mean	15.68	31.45	181.2	11.20	1.50	2.85	5.05	8250
	Std. Dev.	0.40	1.20	1.20	1.13	0.42	0.78	0.78	1202
	Std. Error	0.29	0.85	0.85	0.80	0.30	0.55	0.55	850
H12	Mean	14.09	26.13	148.5	12.13	1.73	3.67	9.50	4500
	Std. Dev.	0.74	2.04	11.38	0.84	0.57	1.52	0.10	692.
	Std. Error	0.42	1.18	6.57	0.48	0.33	0.88	0.06	400.

Source: Prepared by the authors using SPSS

Cluster B12, formed by the counties of Bistrita-Nasaud, Maramureş, Mures, Satu Mare and Neamt, recorded very good values regarding SCPUE12, 20.72 students per classroom (with 15.0% below average), SPCPUE12, 10.02 students per PC (with 9.5% below average), as well as STPUE12, 14.30 students per teacher (2.9% below average), but high values for SLPUE12, 171.32 students per laboratory (5.1% above the national average in pre-university education, of 162.98 students per laboratory).

The D12 cluster, formed by the counties of Arad, Brasov, Sibiu and Timis, also recorded very good values, below the national average, regarding STPUE12, 14.43 students per teacher (2.1% below average), SCPUE12, 21.88 students per classroom (10.3% below average), SLPUE12, 143.45 students per laboratory (12.0% below average), as well as SPCPUE12, 10.70 students per PC in pre-university education (3.3% below average).

Cluster A12, formed by the counties of Arges, Bihor, Cluj, Dambovița, Hunedoara, Gorj, Olt and Valcea, is also characterized by lower values than the national average at STPUE12, 14.13 students per teacher (4.1% below average), of SCPUE12, 23.66 students per classroom (3.0% below average), SLPUE12, 157.33 students per laboratory (3.5% below average) and of SPCPUE12, 10.74 students per PC (3.0% below average).

Although, with good values of the infrastructure of the educational process and of students per teacher in pre-university education, compared to the other clusters, clusters C12, B12, D12 and A12 differ fundamentally from the point of view of school dropout rate and unemployment rate.

Thus, in cluster A12 school dropout rate in primary and secondary education (SDRPSE12) was 0.76%, the lowest value among the eight clusters, with 45.5% less than at national level (1.40%), school dropout rate in high school and professional education (SDRHPE12) was 1.69%, also the lowest value among the eight clusters, with 41.8% less than at national level (2.90%), and the unemployment rate (UEPR12) was 6.21%, with 15.0% higher than at national level (5.40%).

In clusters C12 and B12, SDRPSE12 was 1.38% and 1.44%, respectively, and SDRHPE12 recorded significantly higher values than the national averages, of 3.23% (11.5% higher) and 4.54% (56.6% higher), this being the highest SDRHPE12 value among the eight clusters., and in C12 UEPR12 was 6.82% (the third highest value, 26.2% higher than at the national level).

In cluster D12, values above the national level were recorded for SDRPSE12 of 2.18% (55.4% more) and for SDRHPE12 of 3.83% (31.9% more), but UEPR12 was 3.75%, being the lowest value unemployment rate in the eight clusters, 30.6% lower than at the national level.

These results highlight the fact that, at least in the case of the four clusters, with values of the pre-university education infrastructure below the national averages, these differences are not necessarily consequences of the infrastructure of the education process, but, rather, of the significant differences regarding the standard of living between the counties included in the four clusters. If in cluster C12, GDP12 was between 4800 euros per inhabitant, in Covasna county and 7000 euros per inhabitant, in Alba county, in cluster B12, GDP12 was between 4100 euros per inhabitant, in Neamț county, and 5600 euros per inhabitant, in Mureş county, in cluster A12, GDP12 was between 4100 euros per inhabitant, in Olt county, and 8600 euros per inhabitant, in Cluj county, and in cluster D12, GDP12 was between 7100 euros per inhabitant, in Arad county, and 9200 euros per inhabitant, in Timis county.

In opposition to the four clusters analyzed above, the other four clusters are characterized by weaker values regarding both the infrastructure of pre-university education and, with the exception of cluster H12, regarding students per teacher in pre-university education. From these points of view, more unfavourable situations were registered in clusters G12 and F12, followed by E12.

The G12 cluster, formed by Constanța and Prahova counties, in comparison with the average values recorded at the national level, is characterized by the highest values of STPUE12, 15.68 students per teacher (6.4% above average) and of SCPUE12, 31.45 students per classroom (with 28.9% above average), as well as with high values of SLPUE12, 181.25 students per laboratory (11.2% above average) and SPCPUE12, 11.20 students per PC (1.2% above average).

Cluster F12, formed by Calarasi, Giurgiu, Galati, Suceava and Vaslui counties, similar to cluster G12, is characterized by the highest values of SLPUE12, 201.7 students per laboratory (23.8% above average) and SPCPUE12, 12.94 students per PC (16.9% above average) and high values of STPUE12, 15.44 students per teacher (4.8% above average) and SCPUE12, 28.24 students per classroom (15.08% above average).

In the case of the E12 cluster, there were values above the education infrastructure averages and students per teacher in pre-university education for three indicators: at STPUE12, 15.45 students per teacher (by 4.9% above the average), at SCPUE12, 25.50 students per classroom (by 4.6% above average), and at SLPUE12, of 181.64 students per laboratory (11.5% above average). The SPCPUE12 indicator recorded a value of 11.03 students per PC (0.4% below average).

The eighth cluster, cluster H12, is characterized by above-average values of education infrastructure and students per teacher in pre-university education for only two indicators: SCPUE12, 26.13 students per classroom (7.1% above average) and SPCPUE12, 12.13 students per PC (9.6% above average). The STPUE12 and SLPUE12 indicators showed better values than in the case of the other three clusters: 14.09 students per teacher (4.4% below average) and 148.57 students per classroom (8.8% below average).

Although, there are significant similarities between clusters E12, F12, G12 and H12 in terms of education infrastructure and students per teacher in pre-university education, there are significant differences between them regarding school dropout rate and unemployment rate. Thus, although with unfavourable situations regarding education infrastructure and students per teacher in pre-university education recorded in clusters G12 and F12, in the case of school dropout rate in high school and professional education (SDRHPE12) in G12 the value of 2.85% was recorded (with 1.7 % below average), and F12, 2.38% (by 17.9% below average), in cluster H12, with a much better situation SDRHPE12 was 3.67% (by 26.4% above average). Regarding the unemployment rate, in Cluster G12 a value of only 5.05% was recorded (with 6.5% below average), while in the other three clusters very high values were recorded: 9.5% in H12 (with 75.9% above average), 7.52% in F12 (39.3% above average) and 6.21% in E1212 (15.1% above average).

Finally, comparing these results with the GDP12 values, recorded in the E12, F12, G12 and H12 clusters, it follows that, except for the G12 cluster, where the GDP12 was 8250 euros per inhabitant (19.6% above the average), in the other three clusters values were recorded much lower: 3880 euros per inhabitant in F12 (43.8% below average), 4500 euros per inhabitant in H12 (34.8% below average) and 4571 euros per inhabitant in E12 (33.7% below average).

At the level of 2022, Bucharest Municipality and Ilfov County maintain their characteristic of private administrative entities, so that all 40 counties were included in the cluster analysis. It also resulted in a structure consisting of eight clusters (Table 6), but significantly different from the one corresponding to 2012, not only in terms of the composition of the clusters, but also the appearance of a merger of 13 counties in the A22 cluster, as well as a reduction in their number in the others, so that three clusters (A22, D22 and G22) include 25 counties (62.5%) and the other five only 15 counties (37.5%).

Table 6. Cluster structure at the level of 2022

Cluster	Counties included in the clusters
A22	Arges, Bacau, Bihor, Bistrita-Nasaud, Botosani, Braila, Buzau, Dambovita, Giurgiu, Hunedoara Iasi, Maramures, Suceava
B22	Cluj, Timis
C22	Arad, Neamt, Satu Mare, Sibiu
D22	Alba, Caras-Severin, Gorj, Salaj, Tulcea, Valcea
E22	Brasov, Constanta, Prahova
F22	Covasna, Harghita, Mures
G22	Mehedinti, Teleorman, Vaslui
H22	Calarasi, Dolj, Galati, Ialomita, Olt, Vrancea,

For the data series included in the cluster analysis corresponding to the year 2022, the verification of the homogeneity of their dispersions performed with the Levene test (Table 7) highlights the fact that there are values of $Sig. < \alpha = 0.05$, which leads to the rejection of the null hypothesis H_{01}, the dispersions of the data series are not homogeneous and, consequently , for testing the statistical significance of the average values recorded at the cluster level, the ANOVA methodology cannot be applied

Table 7 Results of the Test of Homogeneity of Variance corresponding to the year 2012

Variables	Levene	df1	df2	Sig.
STPUE22	2.630	7	32	0.029
SCPUE22	2.451	7	32	0.039
SLPUE22	1.251	7	32	0.305
SPCPUE22	2.885	7	32	0.019
SDRPSE21	1.040	7	32	0.424
SDRHPE21	4.134	7	32	0.002
UEPR22	1.122	7	32	0.374
GDP21	1.309	7	32	0.278

Source: Prepared by the authors using SPSS

Under these conditions, the Welch and Brown-Forsythe tests were used to test the statistical significance of the average values recorded at the cluster level.

Table 8 Results of Robust Tests of Equality of Means

		Statistic[a]	df1	df2	Sig.
STPUE22	Welch	8.696	7	9.042	0.002
	Brown-Forsythe	9.221	7	18.633	0.000
SCPUE22	Welch	9.718	7	9.355	0.001
	Brown-Forsythe	11.494	7	7.615	0.002
SLPUE22	Welch	6.131	7	9.247	0.007
	Brown-Forsythe	7.832	7	16.253	0.000
SPCPUE22	Welch	6.230	7	7.508	0.012
	Brown-Forsythe	3.833	7	6.792	0.047
SDRPSE21	Welch	3.324	7	7.799	0.049
	Brown-Forsythe	4.373	7	10.118	0.018
SDRHPE21	Welch	19.844	7	7.761	0.000
	Brown-Forsythe	5.680	7	10.491	0.006
UEPR22	Welch	24.576	7	7.647	0.000
	Brown-Forsythe	18.753	7	17.942	0.000
GDP21	Welch	16.709	7	7.759	0.000
	Brown-Forsythe	15.950	7	13.842	0.000

a. Asymptotically F distributed.

Source: Prepared by the authors using SPSS

The results obtained (Table 8) highlight the fact that all the values of the statistic $F > F_{0.05,7,32} = 2.26$ as well as of $Sig. < \alpha = 0.05$, which leads to the rejection of the null hypothesis H_{02} and the acceptance

of the alternative hypothesis H_{12}. In conclusion, the average values of the variables, recorded at the cluster level, are statistically significant.

Compared to the year 2012, in the year 2022, at the level of the counties in Romania, there are both reductions and increases in the volume of pre-university education resources per student. Thus, in the case of the number of students per teacher, the most significant reduction was recorded in Botoşani County, by 18.10%, but there is one county, Ialomița County, where the number of students per teacher increased by 2.22%. Similar situations were also recorded in the case of students per laboratory and students per workroom where, out of the 40 counties included in the cluster analyses, in 12 (30.0%) there were increases in students per laboratory, and in 18 (45.0%) increases in students per workroom. On the other hand, reductions were recorded in all 40 counties, in the case of students per classroom, ranging between 23.36%, in Gorj, and 0.98% in Braşov, as well as regarding students per PC, ranging between 27.27% , in Botosani, and 21.89% in Brasov.

In the same period, there were increases in the school dropout rate in primary and secondary education in 12 counties (30.0%), and in the dropout rate in high school and professional education in 8 counties. Regarding the unemployment rate, with the exception of Valcea county, reductions were recorded in the other counties, the most significant being in Bihor county (by 71.43%).

Table 9 The main characteristics of the clusters, corresponding to the year 2022

Cluster	Parameter	Characteristics of clusters							
		STPUE22	SCPUE22	SLPUE22	SPCPUE22	SDRPSE21	SDRHPE21	UEPR22	GDP21
A22	Mean	13.4	20.9	164.	4.31	0.66	1.55	3.3	866
	Std.	0.52	2.13	20.5	0.89	0.42	0.79	1.1	156
	Std.	0.14	0.59	5.71	0.25	0.12	0.22	0.3	434
B22	Mean	13.2	20.4	148.	4.80	0.90	1.85	1.0	171
	Std.	0.14	0.28	3.75	1.98	0.28	0.21	0.2	106
	Std.	0.10	0.20	2.65	1.40	0.20	0.15	0.2	750
C22	Mean	13.5	19.1	143.	5.68	1.78	3.95	2.7	103
	Std.	0.44	0.84	16.6	0.41	0.66	1.57	1.3	233
	Std.	0.22	0.42	8.31	0.21	0.33	0.78	0.6	116
D22	Mean	12.5	18.6	108.	4.33	1.13	1.78	3.6	107
	Std.	1.09	2.25	16.4	0.77	0.41	0.44	0.8	107
	Std.	0.45	0.92	6.73	0.31	0.17	0.18	0.3	440
E22	Mean	14.6	27.0	175.	7.63	1.73	2.53	2.2	136
	Std.	0.44	3.50	24.4	1.11	1.05	0.60	0.0	907
	Std.	0.25	2.02	14.1	0.64	0.61	0.35	0.0	524
F22	Mean	11.3	17.3	168.	5.03	2.27	3.27	3.8	970
	Std.	0.53	1.29	9.40	1.65	0.65	0.06	0.6	954
	Std.	0.31	0.74	5.43	0.95	0.38	0.03	0.3	551
G22	Mean	12.6	20.4	157.	3.50	1.13	1.90	7.8	730
	Std.	0.46	0.93	18.0	0.50	0.25	0.75	0.9	144
	Std.	0.26	0.54	10.4	0.29	0.15	0.44	0.5	833
H22	Mean	14.2	24.4	151.	5.95	1.82	2.95	5.5	825
	Std.	1.11	1.32	20.7	1.75	0.75	1.02	1.0	102
	Std.	0.45	0.54	8.47	0.72	0.30	0.42	0.4	417

Source: Prepared by the authors using SPSS

At the cluster level (Table 9), clusters B22, C22 and D22 are characterized by values of students per teacher, students per classroom and students per laboratory lower than the national average, as well as higher values regarding students per PC. Thus, cluster D22, formed by the counties of Alba, Caras-Severin, Gorj, Salaj, Tulcea and Valcea, recorded very good values regarding STPUE22, 12.52 students per teacher (8.10% below average), SCPUE22, 18.67 students per classroom (with 15.04% below average) and SLPUE22, 108.42 students per laboratory (with 30.54% below average). Cluster B22, formed by the counties of Cluj and Timis, recorded good values regarding STPUE22, 13.20 students per teacher (with 3.08% below average), SCPUE22, 20.40 students per classroom (with 7.15% below average) and SLPUE22, 148.15 students per laboratory (with 5.08% below average), and in the C22 cluster, formed by the counties of Arad, Neamt, Satu Mare, Sibiu, there were 13.55 students per teacher (with 0.51% below average), 19.10 students per classroom (with 13.06% below average) and 143.35 students per laboratory (by 8.04% below average). Regarding students per PC, SPCPUE22 registers values between 4.33 (cluster D22) and 5.68 students per PC (cluster C22).

Clusters A22, F22 and G22 characterized by values lower than the national average of STPUE22 and SCPUE22, and with values higher than the national average of SLPUE22 and SPCPUE22, except G22 at SPCPUE22. Cluster F22, made up of Covasna, Harghita and Mures counties, recorded the best values among all clusters for these indicators, 11.30 students per teacher (17.03% below average) and 17.37 students per classroom (20.59% below average), but some of the highest values compared to the average, 168.83 students per laboratory (8.17% above average) and 5.03 students per PC (18.43% above average). Cluster A22, formed by the counties of Arges, Bacau, Bihor, Bistrita-Nasaud, Botosani, Braila, Buzau, Dambovita, Giurgiu, Hunedoara, Iasi, Maramures and Suceava recorded 13.49 students per teacher (with 0.94% below average) and 20.98 students per classroom (4.52% below average), respectively, 164.42 students per laboratory (5.34% above average) and 4.41 students per PC (1.36% above average). In the case of the G22 cluster, made up of Mehedinti, Teleorman and Vaslui counties, good values were recorded in STPUE22, SCPUE22 and SPCPUE22: 12.60 students per teacher (7.49% below average), 20.47 students per classroom (6.84% less) and 3.50 students per PC (17.65% below average), but values above average at SLPUE22, 157.60 students per laboratory (0.97% above average).

Finally, in the other two clusters (E22 and H22) values above the national average were recorded both regarding the number of students per teacher and regarding the infrastructure of pre-university education. Of these, the most unfavourable values were recorded in the E22 cluster formed by the counties of Brasov, Constanta and Prahova. Compared to the national average, in the E22 cluster there were 14.60 students per teacher (7.20% above average), 27.0 students per classroom (22.89% above average), 173.43 students per laboratory (12.40% above average) and 7.63 students per PC (79.61% above average).

From the point of view of school dropout rate in primary and secondary education (SDRPSE21), dropout rate in high school and professional education (SDRHPE21), unemployment rate (UEPR22), as well as gross domestic product per inhabitant (GDP21) there are significant differences in all three groups of clusters analyzed above. Thus, while in the group formed by the B22, C22 and D22 clusters, important similarities were recorded regarding the number of students per teacher and the educational infrastructure compared to the other clusters in the group, in the C22 cluster high values were recorded at SDRHPE21 (1.78%) and SDRHPE21 (3.95%), with 0.59 and 1.85 percentage points above the national average, respectively, and in cluster D22 high values were recorded at GDP21 (3.68%), with 0.68 percentage points above the national average. Regarding the B22 cluster, values below the national average were recorded both in terms of dropout rate and unemployment rate, where the lowest value of UEPR22 ((1.0%), as well as the highest value of GDP21 (17150 euros per inhabitant) of all eight clusters corresponding to the year 2022. A similar situation was recorded in the group formed by clusters E22 and H22 where, with similar situations regarding the number of students per teacher, educational infrastructure, school dropout rate in primary and secondary education (SDRPSE21) and dropout rate in high school and professional education, cluster H22 recorded one of the highest unemployment rate values (5.58%), with 2.58 percentage points above the national average and the

lowest value of gross domestic product per inhabitant (8250 euros per inhabitant) with 4350 euros per inhabitant below the national average , while the E22 cluster recorded one of the lowest unemployment rate values (2.23%), with 0.77 percentage points below the national average and the second highest value of gross domestic product per inhabitant, after the B22 cluster, (13633 euro per inhabitant) with 1033 euros per inhabitant above the national average.

Finally, the two administrative territorial entities not included in the cluster analyses, Ilfov County and Bucharest Municipality, at the level of 2012, are characterized by high values, significantly above the national average, both regarding the number of students per teacher, and regarding the infrastructure of pre-university education in the entire period. At the level of 2022, the situation changes only regarding the number of students per PC, where values below the national average are recorded. Thus, Ilfov county recorded the highest values among all 42 territorial administrative entities regarding students per teacher (17.76), with 34.41% above average, students per classroom (33.0), with 50.15% above average and students per laboratory (231.98), with 48.63% above the average, but lower values than the national average regarding students per PC (3.83), with 0.4 percentage points below the average. In the same year, at the level of the Municipality of Bucharest, there were: 15.84 students per teacher (16.27% above the average), 30.77 students per classroom (40.08% above the average) and 194.11 students per laboratory (24.36% above the average), as well as the lower value regarding students per PC (2.33), with 1.92 percentage points below the national average. On the other hand, both territorial administrative entities are characterized by low values (below the national average) regarding school dropout rate in primary and secondary education, dropout rate in high school and professional education and unemployment rate, as well as the highest values regarding gross domestic product per inhabitant, which in 2021 was 34,200 euros per inhabitant, in the Municipality of Bucharest, with 21,600 euros per inhabitant above the average, respectively of 13,300 euros per inhabitant with 700 euros per inhabitant above the national average.

4. Conclusions

The analyzes carried out highlighted a series of contradictions between the resources of pre-university education (the number of students per teacher and the education infrastructure) and the performances recorded in the fields of school dropout rate in primary and secondary education, dropout rate in high school and professional education, unemployment rate and gross domestic product per inhabitant.

At the level of 2012, the aggregated average values of GDP12 in clusters G12, of 8,250 euros per inhabitant, 19.6% higher than at the national level (6,900 euros per inhabitant) and D12 of 8,175 euros per inhabitant, 18.5% higher than at the national level, they are in contradiction with the characteristics of the resources of the educational process, an aspect highlighted by the fact that, in the G12 cluster, the most unfavorable values regarding the number of students per teacher and the infrastructure of pre-university education were recorded, but values below the national average for the dropout rate in high school and professional education and unemployment rate.

At the level of 2022, the contradictory aspects are maintained in some clusters. For example, in the E22 cluster where the most unfavorable values regarding the number of students per teacher and the education infrastructure were recorded, low unemployment rate values were recorded, as well as the second value of gross domestic product per inhabitant (8.20% above the national average). On the other hand, however, at the level of cluster B22 (Cluj and Timis), concordances were recorded between the resources of the education process and the school dropout rate and unemployment rate, with the highest average value of gross domestic product per inhabitant being recorded here.

The other two administrative entities also highlight the fact that the resources of the education process do not match the performances obtained regarding the school dropout rate and unemployment rate, in the sense that, although these are characterized by high values, both regarding the number of students per teacher and regarding the infrastructure of pre-university education, except for the number of students per PC, from the point of view of school dropout rate and unemployment rate, it is

characterized by low values (below the national average), as well as by the highest values of gross domestic product per inhabitant.

In conclusion, the obtained results highlight the fact that the education infrastructure and students per teacher in pre-university education, at the level of the counties included in the analysis, do not significantly influence either the school dropout rate in pre-university education or the unemployment rate. These are mainly influenced by the levels reached in local and regional sustainable development, a fact highlighted by Ciumas et.al. [Ciumas et.al., 2017] in the paper Education and employment rate in Romania.

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