HUMAN, TECHNOLOGIES AND QUALITY OF EDUCATION, 2023
https://doi.org/10.22364/htqe.2023.14

SCHOOL SOCIOECONOMIC SEGREGATION IN BALTIC SEA COUNTRIES

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ABSTRACT

School socioeconomic segregation has an impact on students' academic performance and affects equity in education. This study aims to evaluate socioeconomic segregation in schools and its changes in the previous decades, using data obtained from international large-scale assessments (ILSA). In this study, data from eight European Union (EU) countries bordering the Baltic Sea (i.e. Latvia, Estonia, Lithuania, Denmark, Sweden, Finland, Poland and Germany) were analysed. Data from two International Association for the Evaluation of Educational Achievement (IEA) studies, i.e. Trends in International Mathematics and Science Study (TIMSS) 2015 & 2019 (Grade 4), and International Civic and Citizenship Education Study (ICCS) 2009 & 2016 (Grade 8), and data obtained from 7 cycles (2000 to 2018) of Organization for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA) were used for the analysis.

School segregation was assessed by calculating Dissimilarity Index. In each country, students in the highest 10% of socioeconomic status (SES) of their families and in the lowest 10% of SES of their families were examined. These two groups accordingly had the highest and the lowest achievements in students' tests in each country.

The obtained results show that the highest school segregation can be observed in Germany, Lithuania, Poland, but the lowest – in Finland and Sweden. The authors conclude that there is no significant decrease in segregation in the previous two decades, which would promote equal education opportunities. OECD PISA 2018 results show that in Estonia, Latvia, Lithuania and Poland highest segregation for low SES group is in large cities, but for the high SES group – in rural areas. The causes of school segregation might be explained as – (1) high SES students reluctance to (or parents preference not to) attend small schools, (2) exclusion (e.g. through entrance exams) of low SES students from schools in large cities.

Keywords: *PISA, ICCS, TIMSS, socioeconomic segregation, the Dissimilarity Index*

Introduction

Latvia is one of the Baltic Sea region countries outlined in this study as Latvia is opening a new chapter in education by reorganising the school network and introducing

the new education curriculum. Latvia is aiming for better and more successful education system, that provides equal educational opportunities to all members of society, regardless their financial situation or geographical location, therefore it is important to analyse tendencies in Latvia and Baltic Sea region countries in order to make an evidence based decisions and learn from different education systems.

The successful education system, which provides equal educational opportunities to all members of society is the basis of a society with high human capital. Technological progress demands highly qualified, talented professionals, and that promotes the need to rise human capital, which is undeniably related to one's education, as the school system can be a crucial determinant of a country's economic performance (Henrecson & Wennström, 2022).

Social and economic welfare, especially for countries with low industrial potential and few natural resources highly depends on educated human resources, which could provide an economic return by lowering unemployment and increasing the earning rates. Previous studies show that long-term human capital productivity gains from the quality rather than the quantity component of human capital (Égert et at., 2022) – which is especially crucial for countries with small population rates. A highly educated society also has non-economic benefits such as health improvement, higher civic participation, increased overall happiness, and what's more important – it promotes the education of the next generation (OECD, 2001).

Unfortunately, educationally disadvantaged parents tend to pass down their low education level to their children, and students with low socioeconomic status (SES) are likely to cluster in schools with similarly disadvantaged peers (Publications Office of the European Union, 2022). Students from low socioeconomic families struggle to get out of the vicious circle of poverty and poor education, as they tend to gain lower education levels and drop out of education institutions in earlier stages of education than their peers (UNESCO, 2017; Sciancalepore, 2017; Winding & Andersen, 2015; Kearney & Levine 2016).

The majority of urban communities have higher incomes than rural communities therefore students in rural areas can easily become trapped in a life in poverty (Awang et al., 2021) and often face economic despair. Schools with high SES can become the first place where students from low SES backgrounds can interact with students from high SES backgrounds to develop their social elasticity, fulfill their own potential and to make the first steps in breaking the vicious circle of poverty. Schools with high SES might serve as a first place of socioeconomic integration for students from low SES backgrounds. Yet it is not uncommon that schools' SES level is set by its location (OECD, 2018). In the context of equity in education, this should be changed as all students regardless of their background have rights to access high quality education.

This study focuses on evaluating equity in education by taking into account students' socioeconomic status. Previous studies confirm that poverty has a negative impact on students' academic performance (Betancur et al., 2018; Galindo & Sonnenschein, 2015; Karklina, 2013). Students in rural areas are more likely to come from low-income families

and show lower academic performance rates in international large-scale assessments (ILSA). Students living in urban areas are having the urban advantage to access better resources in terms of infrastructure, proximity to services, higher family income and better overall education opportunities yet all this applies to students from wealthier families, leaving students from poorer urban families in disadvantaged position causing so-called "urban paradox" (Unicef, 2019; OECD, 2013).

Although the urban advantage varies across countries, in the context of education it has proven to be true: urban students have greater access to high-quality education and overall they tend to outperform their rural peers (Geske et al., 2022; OECD, 2016, 2017, 2020; Karklina, 2013). Economic inequity without a doubt is the main cause of residential segregation by income and it does have a negative effect on the funding of schools. Low-income families can provide less funding than high-income families (Kearney & Levine 2016) which partially explains the school segregation.

In all three studies i. e. Organization for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA), International Association for the Evaluation of Educational Achievement (IEA) Trends in International Mathematics and Science Study (TIMSS) and IEA International Civic and Citizenship Education Study (ICCS) which forms the methodological basis of this study, students' socioeconomic status (SES) tend to show an influence on students' academic performance (Mullis et al., 2020; Schulz, et al., 2018; Geske et al., 2015). Students' families' socioeconomic status is an aspect that cannot be easily changed in the context of the improvement of education quality, yet there is another aspect that has an impact on students' academic performance – the school's socioeconomic status.

In contrast with students' SES, school's SES can be changed by changing the composition of students in school. According to OECD PISA results, in the case of Latvia, student academic performance is more affected by school's SES than by students' family's SES (Geske et al., 2015; Geske et al., 2020). Similar results were obtained in ILSA studies outside the methodological scope of this study, i.e., in IEA International Computer and Information Literacy Study (ICILS) 2018 and in The Progress in International Reading Literacy Study (PIRLS) 2016 where school SES served as a positive predictor of student achievement for the majority of participating countries (Schulz et al., 2018; Mullis et al., 2017).

Although there has been an ambiguity about the school's socioeconomic status measures as, firstly, there is no clear definition of SES, secondly, SES measures are based on a limited age group or grade and therefore might not represent the full school's socioeconomic profile (Avvisati, 2020) it still remains a great predictor for students' academic performance. There is no doubt that high-performing students are important for a country's economic development, yet OECD PISA and especially IEA International Civic and Citizenship Education Study (ICCS) results show that Latvia struggles to break out of average student performance and to reach the highest levels in international large – scale assessments (Geske et al., 2015; Cekse 2021, 2022; OECD, 2019d). An exception in the case of Latvia is the IEA Trends in International Mathematics and Science Study (TIMSS), where students tend to show results that are above the average performance

(Mullis, et at., 2020, Mihno & Geske, 2020), but the number of students that reaches top level performance still remains low.

Methodology

In order to obtain the results quantitative research design was used. The authors used descriptive research design in order to reach the main aim of this study: to evaluate school socioeconomic segregation and its changes in the previous decades, using data obtained from international large-scale assessments in education in order to determine changes in school segregation of Baltic Sea countries during the last decade.

Several methods and criteria can be applied for distinguishing socioeconomic status groups. E.g., considering parents' education where one group consists of students whose parents have only primary education, and the other – students, who's parents have higher education (Bartholo, 2013). If SES scales are available, as it is in the case of ILSA studies, then a certain size group can be distinguished at the top and at the bottom of the scale.

In this study two different student groups were analysed. One group combines 10% of students from families with high SES (i.e. high SES group), and the other – 10% with low SES (i.e. low SES group). Groups of 25% students are allocated relatively more often than the groups of 10% (OECD, 2019c; OECD, 2022; Martínez-Garrido et at., 2020), but in this study a 10% groups with the highest and lowest students family's SES levels were used. Students from these two groups accordingly have the highest and the lowest achievement levels in student tests (Geske et al., 2015).

Data from two ILSA studies – TIMSS 2015 & 2019 (Grade 4), two cycles of ICCS 2009 & 2016 (Grade 8) as well as the seven cycles of OECD PISA (2000 to 2018) of EU countries bordering the Baltic Sea, who participated in these studies were used. The choice of countries was justified by their geographical proximity and mutual historical interaction that have influenced the development of education systems, including the education system of Latvia.

In order to determine students' SES, the specific indices for determining the socioeconomic status in each study were used, e. i., in IEA TIMSS – Home Resources for Learning Scale (Martin et al., 2020), IEA ICCS – National Index of Students' Socioeconomic Background (Schulz et al., 2017), OECD PISA – Index of Economic, Social and Cultural Status (OECD, 2019d).

Figure 1 show that the average students' SES has a significant effect on the school's average test scores. Data on the horizontal axis represents the particular SES group. In OECD PISA each school is divided into 10 similar groups according to students' SES. In OECD PISA students' SES is assessed by the Index of Economic, Social and Cultural status (ESCS). Group 1 aggregates schools with lowest SES, and Group 10 aggregates schools with the highest SES. Data on the vertical axis represents the average Science Literacy achievements of the particular school group. Only three of the considered countries (Estonia, Finland, and Latvia), have less than 100 points achievement gap between the first and the tenth school group. The largest gap differences are in Germany (189 points) and Lithuania (148 points).

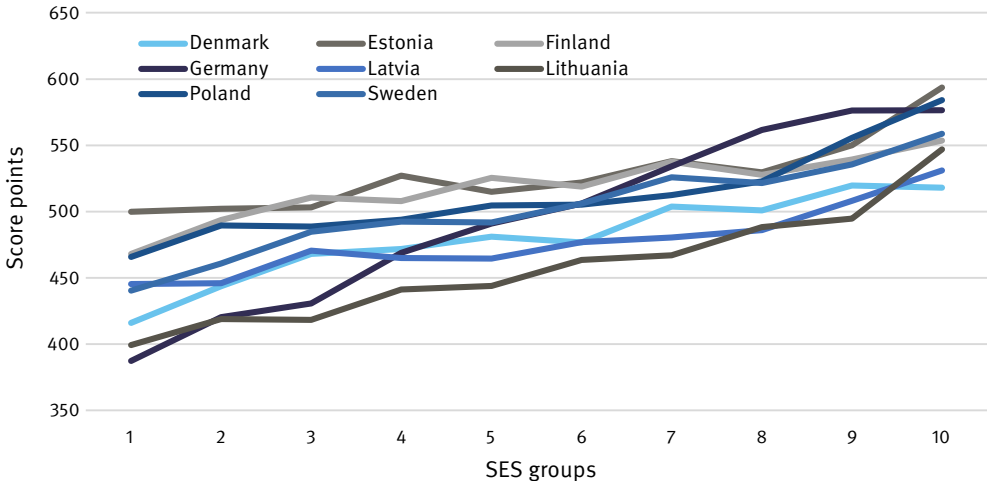

Figure 1 Schools' average SES impact on schools' average achievements in Science Literacy

For school segregation assessment a various indices can be used – e.g., Dissimilarity Index (DI), Isolation Index, Diversity Index, and Segregation Index. Each of them has a slightly different interpretation, but the inter-correlation between them is relatively high (Martínez-Garrido et al., 2020; OECD, 2019c), therefore the most common measure of segregation, Dissimilarity Index (DI), was used in this study.

Segregation indices measure the extent to which the actual distribution of a group of students across schools differs from the random distribution of the same group of students across different schools. It examines two student groups and compares their proportions. The current study examines two different cases – (1) one group allocates students from low SES families and the other group allocates all other students; (2) one group allocates students from high SES families and the other group – all other students. In both cases, the calculation procedures remain the same with a difference in data.

For the group of low SES students, the DI is calculated as seen in (1) : n^a_i is the number of students in a school i from families with low SES, and N^a is the number of students in the entire sample with m schools. n^b_i is the number of other students in school i and N^b is the number of other students in all sampled schools combined (OECD, 2019c).

$$D = \frac{1}{2}\sum_{i=1}^{m}\left|\frac{n_i^a}{N^a} - \frac{n_i^b}{N^b}\right| \quad (1)$$

If the number of low SES group in each school is proportional to the number of low SES students in the country, then the dissimilarity index will be D = 0. The index will be at its peak if low SES group only attend schools with no other than low SES students.

The index can be interpreted as the proportion of students who would have to be transferred to other schools so that their distribution in schools is proportional to the distribution in the country. For example, D = 0.40 indicates that to achieve equal distribution 40% of students from one or the other group should be transferred to other schools.

Results

The DI obtained in ICCS for high SES group (see Table 1) is higher than for the low SES group. For all countries, DI values for the high SES group are close – from 0.54 to 0.56, with the exception of Latvia. In Latvia, the DI of this group is lower than in other countries and in even lower in comparison with the low SES group.

From 2009 to 2016, the DI for the high SES group in all countries included in this study hasn't changed significantly, with the exception of Latvia, where DI has increased, what means that only 62% of schools are attended by students from the group with the 10% highest SES. The DI of the low SES group in all countries included in this study also didn't show a significant change, with an exception of Denmark where it has slightly increased.

IEA ICCS 2016 Latvia's data was analysed in relation to school location (rural school or urban school) and school size (up to 300 students, from 300 to 600 students and above 600 students). In Latvian schools higher DI for high SES students are in rural school group (0.43), as well as in small schools (0.51) For low SES students, the situation is the opposite: higher DI is in urban schools (0.52) and in large schools (0.47).

OECD PISA offers greater options for data analyses as this study covers almost two decades (see Table 2). This study takes place every 3 years. Latvia as the majority in Baltic Sea region countries has taken part in each OECD PISA cycle starting from 2000 to 2018 – which covers seven study cycles, with the exception of only two countries: Estonia and Lithuania which joined this study in 2006.

Table 1 SES Dissimilarity Index of countries bordering the Baltic Sea in IEA ICCS and IEA TIMSS

ICCS			TIMSS		
Country/Year	**Low SES**	**High SES**	**Country/Year**	**Low SES**	**High SES**
BCP 2009	0.38	0.55	DNK 2015	0.48	0.41
DNK 2016	0.43	0.55	DNK 2019	0.44	0.41
EST 2009	0.42	0.55	FIN 2015	0.36	0.31
EST 2016	0.44	0.55	FIN 2019	0.35	0.36
FIN 2009	0.40	0.55	DEU 2015	0.53	0.52
FIN 2016	0.40	0.55	DEU 2019	0.50	0.53
LTU 2009	0.50	0.56	LTU 2015	0.52	0.44
LTU 2016	0.49	0.55	LTU 2019	0.57	0.54
LVA 2009	0.47	0.39	LVA 2015	...	...
LVA 2016	0.48	0.45	LVA 2019	0.48	0.40
SWE 2009	0.42	0.55	POL 2015	0.38	0.41
SWE 2016	0.42	0.54	POL 2019	0.43	0.38
			SWE 2015	0.51	0.36
			SWE 2019	0.46	0.42

Table 2 SES Dissimilarity Index of countries bordering the Baltic Sea in OECD PISA

Year	Low SES	High SES	Low SES	High SES	Low SES	High SES	Low SES	High SES
	DNK	DNK	EST	EST	FIN	FIN	DEU	DEU
2000	0.40	0.42	...	...	0.34	0.38	0.47	0.49
2003	0.40	0.46	...	...	0.32	0.37	0.50	0.55
2006	0.37	0.41	0.41	0.37	0.34	0.37	0.52	0.49
2009	0.44	0.55	0.39	0.36	0.32	0.39	0.50	0.51
2012	0.46	0.42	0.40	0.40	0.35	0.35	0.48	0.48
2015	0.44	0.44	0.42	0.43	0.32	0.32	0.46	0.51
2018	0.45	0.39	0.41	0.42	0.33	0.39	0.51	0.50
	LTU	LTU	LVA	LVA	POL	POL	SWE	SWE
2000	...	...	0.39	0.40	0.42	0.55	0.32	0.38
2003	...	...	0.43	0.42	0.44	0.46	0.37	0.38
2006	0.45	0.45	0.43	0.38	0.44	0.49	0.35	0.42
2009	0.45	0.45	0.43	0.43	0.42	0.55	0.38	0.41
2012	0.47	0.45	0.49	0.46	0.44	0.48	0.38	0.40
2015	0.48	0.40	0.45	0.43	0.39	0.41	0.36	0.38
2018	0.47	0.45	0.47	0.43	0.38	0.47	0.38	0.38

On average, over the whole seven study cycles Germany, Lithuania and Poland show the highest DI in OECD PISA.

As expected, the lowest DI are in Finland and Sweden, where the DI for high SES groups are slightly higher that for the low SES groups.

Analysing the changes in DI over the years, data show that for the high SES group DI has increased in Estonia, for the low SES group DI has increased in Denmark, Lithuania and Sweden, but in case of Latvian the DI has increased for both – low and high SES groups. Out of all Baltic Sea region countries only Poland show the decrease of DI and no significant changes in DI are present in Finland and Germany.

The causes of segregation can be identified by analysing separate school layers. Table 3 show the DI of schools located in settlements with different population size in OECD PISA 2018 study. Analysing the low SES group, in all countries except Germany, in large cities the DI is higher than in rural areas and small towns. The exact opposite can be observed in high SES group. In most countries, DI in large cities is smaller than in rural areas and small towns with the exception of Denmark, Finland and Germany. Very large differences can be observed in Estonia, Latvia and Lithuania. These differences can be explained by the student composition differences in rural areas and in the large cities. In rural areas there are smaller percentage of students from the high SES group and significantly larger from the low SES group. The exception is Denmark, where the distribution is roughly equal. Especially high DI in the high SES group in rural areas can be observed in Estonia, Latvia, Lithuania and Poland.

Table 3 SES Dissimilarity Index of schools in different settlements and countries in OECD PISA 2018

	Low SES	High SES	Low SES	High SES	Low SES	High SES	Low SES	High SES
	DNK	DNK	EST	EST	FIN	FIN	DEU	DEU
A village	0.36	0.40	0.42	0.53	0.19	0.35	...	...
A small town	0.49	0.29	0.33	0.39	0.29	0.43	0.56	0.45
A town	0.50	0.42	0.33	0.39	0.49	0.60	0.50	0.46
A city	0.41	0.39	0.47	0.34	0.42	0.35	0.56	0.50
	LTU	LTU	LVA	LVA	POL	POL	SWE	SWE
A village	0.34	0.65	0.38	0.69	0.33	0.56	...	...
A small town	0.33	0.35	0.34	0.41	0.28	0.41	...	...
A town	0.47	0.37	0.44	0.38	0.36	0.39	...	...
A city	0.48	0.41	0.52	0.37	0.43	0.45	...	...

A village – population size is than 3000; a small town – population size 3000 to 15000; a town – population size 15000 to ~ 100000; a city – population size above 100 000.

Table 4 SES Dissimilarity index of countries' schools with different number of students in OECD PISA 2018

School size	Low SES	High SES	Low SES	High SES	Low SES	High SES	Low SES	High SES
	DNK	DNK	EST	EST	FIN	FIN	DEU	DEU
Small	0.48	0.52	0.41	0.60	0.12	0.13	0.37	0.75
Medium	0.44	0.39	0.37	0.40	0.26	0.34	0.46	0.67
Large	0.47	0.32	0.41	0.38	0.34	0.40	0.54	0.43
	LTU	LTU	LVA	LVA	POL	POL	SWE	SWE
Small	0.39	0.71	0.42	0.57	0.44	0.55	...	...
Medium	0.35	0.40	0.37	0.37	0.35	0.56	...	...
Large	0.44	0.39	0.53	0.40	0.36	0.40	...	...

Note: A small school – number of 9th Grade students is less than 30, average school – number of 9th Grade students varies from 30 to 60, large school – number of 9th Grade students is above 60.

Similar results can be obtained when analysing data by the school size. For the purpose of data analysis 9th Grade students were split into three groups according to the number of 9th Grade students in school – up to 30 students; from 30 to 60 and above 60. 9th Grade is the modal grade in OECD PISA study, i. e., in PISA mainly 9th Grade students are represented.

The results of division by school size overlap with the results of urbanization, because small schools are mainly located in rural areas, nevertheless data analysis also show some dissimilarities. The first dissimilarity can be found in the data obtained from Finland where low, and the lowest DI (0.13) are common in small schools, but in large schools DI is three times higher (0.34 and 0.40). In other Baltic Sea region countries, the highest DI in high SES group is common in small schools (from 0.52 to 0.75), but in low SES group – in large schools (from 0.37 to 0.48) (see Table 4).

Discussion

IEA ICCS data show that in Latvian schools higher DI for high SES students are in rural school group and in small schools, but for low SES students: higher DI is in urban schools and in large schools. Differences in DI in Latvian urban/non-urban and large/small schools can be explained by different amount of students in each low and high SES group. E.g. urban schools have only 5% low SES group, but in non-urban schools – 6% high SES group. The time span between the TIMSS studies is shorter than between the ICCS studies (see Table 1). Therefore, it could be expected, that the changes in DI are smaller, however, for the high SES group this assumption was confirmed only in Denmark, Germany, and Poland, and for low SES group – in Finland and Germany. There is no general trend of increasing or decreasing DI in all countries included in this study. DI has significantly increased only in Lithuania. In other countries, smaller changes have been observed. In order to make detailed conclusions an in-depth study for each country and its education system is needed.

Similar DI calculations as for this study (for 10% groups) based on OECD PISA were made for the United Kingdom schools (Martínez-Garrido et al., 2020). For the low SES group, from 2000 to 2015, DI ranged from 0.36 to 0.43 without a definite trend. Obtained results for Baltic Sea region countries doesn't show a significant difference between the results that were obtained in the study carried out by Martínez-Garrido, Siddiqui and Gorard.

The major concern in the context of segregation is segregation of rural schools, which can be a significant factor for students' low academic achievements. High socioeconomic discrimination of rural schools puts rural schools in a very unfavourable position. This is mainly due to the fact that students' achievements are largely linked to both the family's SES and school's average SES (see Figure 1). Previous studies show that if there are no or few students from high SES families, the average achievements of the whole class significantly reduces (Johansone, 2009). In Latvia and Lithuania only 25% of rural schools have students with high SES, in Estonia percentage is a little bit higher – 35%. The described situation is quite different in Finland and Denmark – in both Scandinavian countries 70% of rural schools have students with high SES. Segregation of rural schools may occur due to a high SES students' or their parents' decision not to attend small rural schools. It should also be noted that in Latvia there is relatively small number of high SES families that are located in rural areas.

Segregation in urban schools could be caused by school division according to students' academic performance. Better chances to enter high-performance schools, e.g., gymnasiums are more likely for students from high SES families. For students from low SES families entering high performing schools can be quite challenging. In the context of equity in education, this should be changed as all students regardless of their background have rights to access high quality education.

Previous studies also show, that schools with low school's SES and with high concentration of disadvantaged students also are having difficulties providing highly qualified,

experienced and effective teachers (OECD, 2019a). Highly qualified teachers tend to prefer schools with academically more advanced students (Pop-Eleches & Urquiola, 2013), but less experienced teachers at the beginning of their teaching career choose to work in schools with denser concentrations of disadvanced students (OECD, 2019b). The lack of equally qualified teachers throughout the whole school network might be another reason that explains school segregation, leading to low or average student academic performance. In latest years some countries, such as Estonia, have proven that it is possible to gain equally good academic achievements in urban and rural areas (OECD, 2018) and that should be the target to aim for.

The lowest school segregation can be observed in Finland and Sweden, but in the latest years data show a slight increase in segregation. This could be explained by the 1990's schools reform and introduction of educational vouchers. The highest segregation indices are in Germany, which in turn, can be explained by the early educational division of students by their academic performance and type of school.

Conclusions

Data analysis show that the socioeconomic segregation of schools by DI in the countries of the same region differs only slightly and in the previous decade, no significant decrease in segregation can been observed. Data show that segregation in Latvian schools can be rated as average with a slight tendency to increase. Equal distribution and declusterization of ineffective schools with low academic performance should be an important aim for education improvement or, in case of Latvia also for the school network reorganisation, in order to provide equal education opportunities to all students.

Analysed countries provides data from very diverse education systems, yet it proves that school SES is linked to the school's academic performance. There is a need for in-depth analysis for each separate country and its education system as well as for a long term monitoring in terms of school segregation in order to spot any major changes.

Author Note

This study was supported by European Social Fund project No. 8.3.6.2/17/I/001 "Participation in International Education Studies".

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