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More give, more get: PISA and TIMMS scores in relation to economic and well-being factors in selected EU countries

Vojtěch Dvořák & Jana Kouřilová

Abstract. The aim of this paper is to identify and assess the factors that are key to educational outcomes in primary education on the basis of the results of selected EU countries in the international PISA and TIMMS surveys and their correlations with selected characteristics of their education systems; a partial aim of this paper is to assess the position of the Czech Republic. The evaluation covers EU countries participating in TIMMS 2014 and PISA 2018. Two indexes were created for the evaluation - the financial index, which is composed of government expenditure on education as a percentage of GDP, spending per student in primary education in US dollars/student and of teachers' salaries, average for primary and lower secondary education with 15 years' experience, and the educational well-being index, which is composed of students per teacher ratio in primary education, teachers by age (50 years and over) in primary education (percentage of all teachers) and teachers (ISCED 1 and ISCED 2) working part-time (percentage of all teachers). By comparing the sum of the indexes with the PISA and TIMMS results, the selected countries were divided into four groups.

Keywords: Educational System, Primary Education Financing, PISA surveys, TIMMS surveys, Public Policy.

Introduction

Human resources are currently the subject of much research, whereby, they are observed and evaluated from different perspectives and in different contexts. One important perspective is the economics, which examines human resources as a workforce that is a crucial factor in economic development. In this context, Drucker (1994) states that knowledge is the main factor of production in a modern advanced economy, and that a worker who wants to participate adequately in the labour market must possess a certain amount of human capital. Patrinos and Angrist (2018) note that a country's human capital is crucial for its economic success, and Checchi (2008) notes that improving access to (quality) education can reduce disparities among countries.

Ensuring the quality of education is, therefore, a major challenge for all countries and certainly depends on, among other factors, its financing, which can significantly influence its effectiveness. Mankiw (2001) and Kameníček (2012) note that investment in education is the most important type of investment. According to Peková et al. (2019), education can be identified as one of the most important sectors of the public sphere; in that, the positive externalities of education have positive benefits for the society as a whole. There are also other sociological factors influencing education inequalities, such as social and cultural capital (Bourdieu, Coleman) through the role of the families (Rogošic and Baranović, 2016). Hence, there are three important research questions: (1) How much do we need to invest in financing education? (2) Is it true that countries with high levels of spending on education also have better educational outcomes in international comparisons? (3) What other factors, if any, influence outcomes?

The main aim of this paper is to identify and assess the factors that are key to good learning outcomes in primary schools, that is, according to ISCED 2011 - P basic education - 244 (NÚP, 2015), by using the results of selected countries in the international PISA and TIMSS surveys and their correlations with selected system characteristics. Since education is a much-discussed issue in the Czech Republic and the need for reform of the education system is constantly being debated, a partial aim of this paper is also to assess the educational position of the Czech Republic, identify the differences in the Czech education system compared to other EU countries, and, with reference to successful systems, formulate recommendations for the forthcoming reform of the Czech education system. The reform of the Czech education system is an important topic in the public and political debate in the Czech Republic. However, different groups have very different ideas about its concrete form, and our aim is to bring a rational perspective to the debate.

The paper is structured as follows. The theoretical background section presents a literature review. The next section characterises the methodology - the selection of countries and the construction of the indexes used. Then, the following section focuses on the results. This is followed by a discussion, which includes recommendations for the Czech Republic. The final section presents the conclusions.

Theoretical departures

At present, in the society of any country, there is no longer any reason to doubt the importance of education, which influences all aspects of an individual's life. As Chalkiadaki (2018) points out, the demands on education change over time, and education must respond to current and future economic, socio-cultural, and also personal needs. The importance of education today is particularly emphasised in the context of new technologies, which are constantly evolving, and have become an integral part of our professional and personal lives. According to Berger and Frey (2016), new jobs, occupations, and industries will emerge as a result of the development of new technologies. More recently, AI and its various use cases have triggered even faster shifts in the professional market (PwC, 2024). On the other hand, some experts emphasise the need to develop complex problem solving, interdisciplinary thinking, critical thinking, creativity, people management, emotional intelligence, etc., in the context of employment (for example, WEF, 2016; Gleason (ed), 2018; Aulbur & Songh, 2014).

According to Scheunpflug (2021), education should also include the key issues of today's world (climate change, population growth and global migration, consumption of natural resources, plastic waste, etc.). The education system should, therefore, prepare educated, skilled, and flexible future workers who are willing to develop their knowledge and skills, even after leaving formal education.

At the beginning of an individual's educational journey there is primary school, which provides basic information about the world and the society. It also shapes his or her relationship with education, which, according to Laal and Salamati (2012), now becomes an essential part of his or her later life. In this context, the quality of education is emphasised. According to Becker (1993), the quality of basic education is crucial for developing human capital. However, the problem may be how to actually define and measure the quality of education due to different historical, socio-cultural, economic, and other conditions in different countries. According to Hanushek and Woessmann (2007), the quality of education is the key issue, especially when evaluating policies related to developing countries. "Providing quality education is a

complex undertaking, in part because the concept of quality in education is continuously evolving” (Laurie et al., 2016, p. 227).

Education takes place in a specific political, geographical, economic, and socio-cultural environment, that creates a space for the learning process (Kučerová et al., 2020). Despite efforts to make quality education available to all, there are significant inequalities in access to education, the functioning of education systems, and the outcomes of the educational process.

Participation in international comparative surveys, such as PISA and TIMSS, is a way of evaluating and comparing the results of the educational process and, thus, its quality. PISA (Programme for International Student Assessment) is an internationally standardised assessment of 15-year-old individuals that was developed jointly by participating countries, in order to measure students’ competence in three areas: reading, mathematical literacy, and scientific literacy (OECD, 1999). Pisa was first organised in 2000, and is administered every three years (Erikson et al., 2019). The focus of the PISA assessment has changed, as the requirements for the types of skills that are needed to meet the demands of the 21st century have changed (He et al., 2017).

TIMSS (Trends in International Mathematics and Science Study) is an international assessment of IEA (International Association for the Evaluation of Educational Achievement) in mathematics and science, that has been conducted on a regular four-year cycle since 1995 (Mullis and Martin, 2012). It is administered to students in grades four and eight. According to Erikson et al. (2019), the TIMSS design is more suitable for assessing the quality of teaching because it links students to the teacher/classroom level, whereas PISA only collects data from students.

The results of both PISA and TIMSS can be interesting and inspiring, with implications for the development of education and education policies in individual countries. According to Wiberg (2019), information from TIMSS can be used to support policy decisions in education. Hopfenbeck et al. (2018) note that, while experts agree on the informative value of PISA data at both the national and international levels, they also criticise the way PISA results are interpreted and used to implement educational reforms. As Gorur (2016) points out, education is not a race that has winners and losers. Therefore, it is necessary to consider reforms in the socio-economic context of a given country.

The perception of the society, regarding the importance of education, affects its financing. Different countries have developed individual education systems, which are financed and organised in different ways, as shown by OECD studies (for example, OECD, 2014, 2015, 2016, 2017, 2022). The financing of education is usually multi-sourced, consisting of public funds (national, regional, local), private household contributions, donor funds, etc.

The proportion of funding from each source depends on the circumstances of a particular country. The level of involvement of local governments in the financing of education can be demonstrated by (1) data on the financial dependence of local governments, (2) earmarked and general transfers from the government, or (3) the share of local government expenditure in GDP (Kuhlmann et al., 2020).

Education systems also differ in their design. The European Commission et al. (2022) divided them into four groups, as follows. There is the “single structure” group, where students follow the same curriculum from the beginning to the end of compulsory education (for example, Northern European countries, Poland, Balkan countries, or Portugal). There is the “common core curriculum” group, where students, after successfully completing primary education (ISCED level 1), progress to lower secondary education (ISCED level 2) with the same curriculum (for example, Southern European countries, Ireland, Romania). And there is the “differentiated” group, where the curriculum for lower secondary education is different, and the student chooses his or her next course of education after successfully completing primary education (ISCED level 1) (for example, Germany, Austria, Lithuania, the Netherlands). Further, a separate group of four countries includes the Czech Republic, Latvia, Slovakia, and Hungary, where “compulsory education is organised in a uniform structure up to the ages of 14, 15, and 16 years, depending on the country; from the ages of 10, 11, and 13 years, pupils may continue in separate educational institutions providing lower and upper secondary education” (European Commission et al., 2022, p. 7).

Education systems across Europe diverse also in institutional arrangements, governance models, and degrees of centralisation or decentralisation. These structural differences shape not only the organisation of compulsory and post-compulsory education but also the pathways (European Commission / EACEA / Eurydice, 2023). A key dimension of divergence lies in the mechanisms of educational financing, particularly in the balance between public and private expenditure. While some countries maintain predominantly publicly funded systems (Denmark, Finland, Sweden, France etc.), others allow for substantial private contributions (Belgium, United Kingdom, Netherlands etc.), either through household spending or the role of private providers (Vera-Toscano, 2013). These variations are further reflected in indicators such as total public expenditure on education and the structure of general government spending, which influence both equity and efficiency within national education systems.

So, what are the factors that influence the quality of the educational process? Indeed, they certainly consist of the society’s perception of the importance of education, and the society’s willingness to invest in it. This is reflected in the way education policies are formulated, implemented, and

financed. In addition, as the OECD (2021) notes, the socio-economic status of the family, and the level of parental education, play important roles. But this paper does not focus on this group of societal and cultural capital. The latter usually influences the perception of the importance of education for the society and, therefore, its financing (Busemeyer & Garritzmann, 2017).

So, what are the factors that influence the quality of the educational process? Indeed, they certainly consist of the society's perception of the importance of education, and the society's willingness to invest in it. This is reflected in the way education policies are formulated, implemented, and financed. In addition, as the OECD (2021) notes, the socio-economic status of the family, and the level of parental education, play important roles. This shows also study by Rogošić and Baranović (2016), who highlight that social and cultural capital significantly shape educational achievements by fostering access to resources, expectations, and support networks crucial for student success. Inequities in learning outcomes has increased in most EU countries because of the socio-economic background (European Commission: Directorate-General for Education, Youth, Sport and Culture, 2024). The latter usually influences the perception of the importance of education for the society and, therefore, its financing (Busemeyer & Garritzmann, 2017).

There is also a strong role of the educational governance policies, as shown in OECD report, e.g. *Education at a Glance* (OECD, 2024). Education policies affects financial framework of the education and strongly stimulates social and cultural capital in the society. One of key measures is the share of the governmental expenditures on the education, second on is the institutional structure of the educational system. In addition, things like curricula, regulations, etc. are also important within the policies (Dudok, 2019).

The most important factors influencing the outcomes of the educational process are, undoubtedly, the personality of the teacher and his or her competences (Darling-Hammond et al., 2019, Cho & Baek, 2019, Bassi et al., 2020). It is, therefore, necessary to create the right conditions (class size, school facilities, or teacher working hours) for teachers to do their job well. The ageing of the population is a major issue today; however, in the case of teachers, this may affect their ability to teach due to physical or mental health (for example, Virtanen et al., 2020). Berk and Weil (2015) point to the potential negative economic impact of an ageing teacher workforce, particularly in relation to modern technology. In some countries, there is also a problem with young people's lack of interest in the teaching profession (European Commission et al., 2021).

The student's personality is also a significant factor, as their abilities and skills are essential to the educational process. As previously noted, social and cultural capital, along with the family background, also play a vital role (Rogošić and Baranović, 2016). However, this study focuses exclusively on

public finance and educational well-being. In this context, well-being is not primarily understood in relation to cultural capital, but rather in terms of teachers' well-being.

Methodology

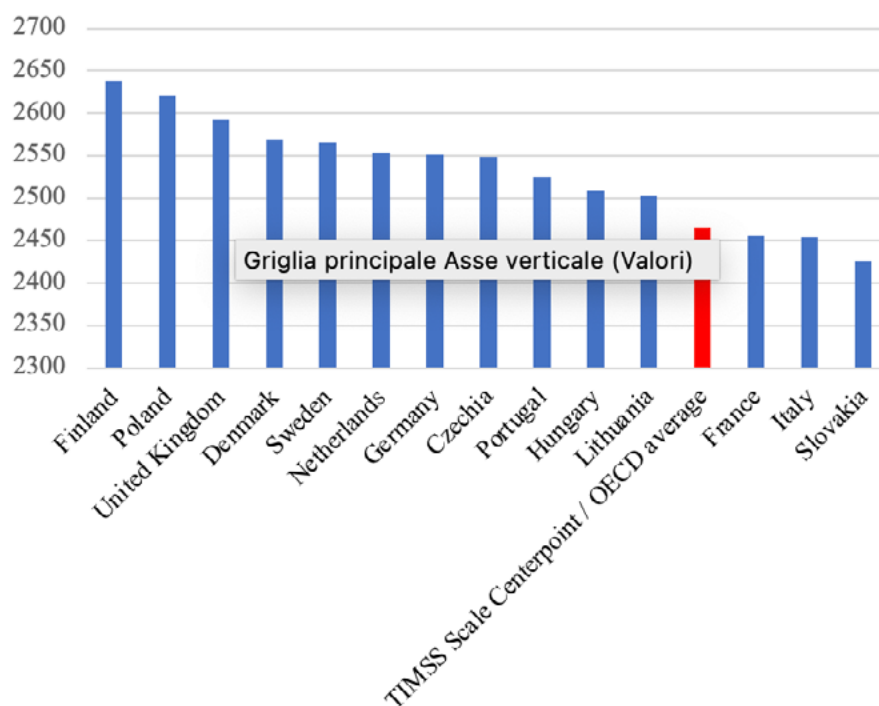
Selection of countries for analysis

The European countries that were selected for analysis and comparison, were those whose students participated in international surveys of learning outcomes; for example, PISA (2018) and TIMSS (2015) for the fourth year of primary school. The reason for selecting only European Union (EU) countries is cultural proximity. Taking into account these two international comparative surveys of learning outcomes, it is possible to observe the evolution and transformation of the performance of a generation of students. Students who were in grade 4 in 2015, and participated in TIMSS 2015 (grade 4), have almost reached the end of their education at the ISCED 2 level in 2018, which is the age at which PISA 2018 was conducted. The selection of countries also took into account the availability of data for the indicators that were chosen in the indexes (see below). These countries are: Czech Republic, Denmark, Finland, France, Germany, Hungary, Italy, Lithuania, the Netherlands, Poland, Portugal, Slovakia, Sweden, and the United Kingdom. The case of Estonia is noteworthy, but it is not included in this analysis as it did not participate in TIMSS, but the Estonia results are among the best in the latest international PISA comparisons.

The results of PISA 2018 and TIMSS 2015 (grade 4) are shown in Fig. 1. PISA covers three domains: reading, mathematics, and science. TIMSS (grade 4) includes science and mathematics. Each of these domains is given a score, and the ranking of countries (performance in international comparisons of student achievement) for the purposes of this research is determined as the sum of these scores. We call this sum the 'PISA 2018 and TIMSS 2015 (grade 4) combined index'.

It is acknowledged that a limitation of the methodology is the restriction to a small number of countries in the analysis. PISA and TIMSS data for the years under study are available for the following countries: Belgium (Flemish), Bulgaria, Croatia, Czechia, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Lithuania, Netherlands, Poland, Portugal, Slovakia, Slovenia, Sweden, and United Kingdom (excluding Scotland). The selection of EU countries for the analysis was based on the availability of data for the indices described below. Due to a paucity of input data, the following countries could not be included in the full analysis: Belgium (Flemish), Bulgaria, Croatia, Ireland and Slovenia.

Figure 1. PISA 2018 and TIMSS 2015 (grade 4) combined index in selected countries



Source: own elaboration based on data by Martin et al. (2016a, 2016b) and OECD (2019).

On the basis of the 'PISA 2018 and TIMSS 2015 (grade 4) combined index', it is possible to rank student performance. In this respect, Finland, Poland, the United Kingdom, and Ireland are the most successful, while Bulgaria, Slovakia, Croatia, and Italy are the least successful. Fig. 1 also shows, for comparison, the sum of the OECD average for the PISA and TIMSS Scale Centrepoint.

Data and Methods

Based on a review of the literature, for the purposes of this paper, the factors influencing the learning environment have been simplified into finance and well-being. The authors are aware that reality is more complex, and that many factors are involved in the outcomes of education systems. A different methodology may produce different results. Nevertheless, this methodology, with its novel approach of two simple indexes, can contribute to the discussion on education, its financing, and its outcomes.

The financial conditions of education are expressed by the *index of finance*, which consists of three indicators. Each of them has a different impor-

tance in the index and enters the calculation with a different weight, based on a review of the literature and knowledge of education finance factors.

The first indicator is “Government expenditure on education as a percentage of GDP”. Its level is indicative of a country’s overall approach to education. It reflects both the wealth of the state and the perception of the importance of education and its contribution to the future. A higher share of education expenditure in GDP is expected to correlate with better performance in international comparisons of student learning outcomes. The weight of this indicator is set at 2, giving it the most important role in the index. This indicator is based on World Bank (2023) data and is an average of the 2013-2020 time series for selected countries. This is an appropriate approach for comparing country performance and removes the bias of short-term economic fluctuations.

The second indicator is Education “spending per student in primary education in US dollars/student”. With more government spending per student, better outcomes of the education system are expected. The weight of this indicator is set at 1, as it is rather complementary, given the different price levels in the selected countries. This indicator is based on OECD (2023a) data, and it is the average of the 2013-2020 time series for the selected countries (for the same reason regarding the previous indicator).

The third indicator is “Teachers’ salaries, average for primary and lower secondary education with 15 years’ experience”. It can be assumed that adequate financial remuneration for teachers makes the profession more attractive, enables teachers to devote themselves to it fully, and attracts/retains more quality staff. The values of this indicator are the average of primary and lower secondary salaries, based on OECD (2023b) data for 2021. This indicator is not available for longer time series, so it is not possible to eliminate possible economic fluctuations. The weight of this indicator is set to 1, as this indicator is also rather complementary, given the different price levels in the selected countries.

All of these indicators show the perception of the importance of education in the societal context (“How much money do we allocate to this?”), and the position of the teacher and, thus, the appreciation of the importance of his or her work in the society.

The *index of educational well-being* characterises the environment in which the educational process takes place, and it is also made up of three indicators, all of which are averaged over the period of 2013-2020, in order to eliminate any extreme fluctuations.

The first indicator is “Students per teacher - primary, ratio”, which is the average of the time series 2013-2020 (for Denmark 2014-2020 and for the Netherlands 2015-2020, due to the unavailability of earlier data); OECD data (2023c). This indicator reflects the possibility to individualise teaching and,

thus, achieve better learning outcomes for students. The weight of this indicator is set at 2, as the number of students per teacher is an important indicator of the quality of the learning environment (Koc and Çelik, 2015).

The second indicator is “Teachers by age - primary, 50 years and over, percentage”, OECD (2023d) data. It can be assumed that older teachers are less energetic, more conservative, and often subject to burnout, and that younger teachers are more open to the application of modern approaches and methods, and the use of modern technology in teaching. While the pedagogical experience of older teachers cannot be ignored, in an era of rapidly advancing technology, the ability/inability to work with technology can have significant implications for the effectiveness of the education system, in relation to the labour market (Berk and Weil, 2015). In this context, it is noteworthy that, in reality, the application of these approaches is highly individual. Nevertheless, the weight of this indicator is set at 2, meaning that it plays a significant role in the educational environment.

The third indicator is “Teachers (ISCED 1 and ISCED 2) working part-time (as % of all teachers)”; Eurostat data (2023). Part-time employment is a flexible way of working that contributes to teachers’ well-being (Darling-Hammond et al., 2019; Cho & Baek, 2019; Bassi et al., 2020). The weight for the indicator is set at 1. It is more of a complementary indicator, influenced by, among other things, institutional practices in the selected countries.

The procedure for calculating both indexes is as follows:

1. For each index, deciles were created from its maximum value. For each indicator, the countries were divided into deciles according to the values of each indicator and scored from 0 to 10 (10 being the best). The number of points obtained was then multiplied by the weight of the indicators in the index.
2. The resulting index score is the sum of the weighted scores of each indicator.

In constructing composite indices related to education financing, it is crucial to ensure that all included indicators are comparable in scale and impact. Indicators such as the share of government expenditure on education relative to GDP, per-student spending in USD, and teachers’ salaries in USD represent different units and magnitudes. Summing their absolute values would risk distorting the significance of each variable - minor changes in percentage-based indicators could be overshadowed by high-magnitude financial figures, despite having substantial implications for education policy. For this reason, the paper employed a standardisation method based on decile distribution of absolute values. This approach allows each indicator to be rescaled to a uniform relative scale, reflecting its position within the broader distribution across countries. As a result, the influence of each vari-

able on the composite index is balanced, and the final index more accurately captures cross-country variation in education financing.

In the simplest terms of this model, the country with the highest value of the index of finance will be the country that allocates the most resources to the education system, and the country with the highest value of the index of education well-being will be the country that creates the most suitable conditions for the implementation of the educational process.

Results

Within the European Union, education systems differ markedly in curriculum design, the adoption of student-centred pedagogies, and broader policy frameworks that influence learning outcomes. Countries such as Finland and Estonia exemplify flexible, competency-based curricula that promote interdisciplinary learning and student autonomy, supported by formative assessment and strong teacher professionalism (Mihail, 2023). In contrast, systems like those in France or Hungary remain more centralised, with rigid curricular structures and a stronger reliance on summative assessment. Other countries, such as the Netherlands and Portugal, lie in between, allowing for partial curricular autonomy at the school level and progressive pedagogical approaches. These variations are further shaped by systemic factors including initial teacher education (e.g. high entry standards in Finland vs. lower barriers in Bulgaria), integration of digital technologies (e.g. high in Estonia, low in Romania), and differing commitments to equity and inclusion, which together amplify disparities in student outcomes across the EU (Mihail, 2023).

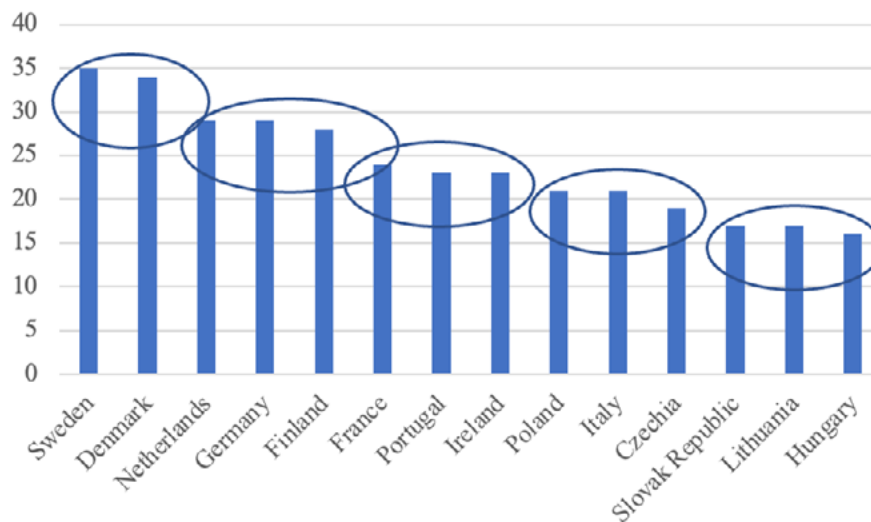
The governance of primary education in Europe is characterised by varying degrees of decentralisation and school autonomy, which significantly shape learning outcomes. Empirical research suggests that greater school autonomy - particularly in curricular and personnel matters - can be positively associated with student achievement, especially when accompanied by strong accountability mechanisms and professional leadership (OECD, 2016b; Hanushek, Link, & Woessmann, 2013). The Czech Republic represents a system with relatively high school-level autonomy, particularly in organisational and staffing decisions, yet it lacks an effective intermediate governance layer between the national ministry and individual schools (European Commission/EACEA/Eurydice, 2020). This fragmented structure may limit the strategic coordination of resources and pedagogical support at the regional level, which in turn affects equity and coherence in education provision. Cross-country comparisons further show that systems with clearly defined multilevel governance - such as those in the Netherlands or Austria -

tend to balance school autonomy with structured policy alignment, resulting in more consistent educational performance across regions (OECD, 2018).

Based on the methodology used, the results of the index of finance are as follows (Fig. 2). Sweden and Denmark seem to be the most successful countries. Both have high scores for all indicators, except for teachers' salaries in Sweden, which are rather average. Teachers' salaries are highest in Germany, which together with the Netherlands and Finland forms the second group of countries. In the Netherlands and Finland, the values of the indicators in this index are fairly balanced. The third group is made up of France, Portugal, and Ireland. France and Portugal have low levels of teachers' salaries, but higher levels of government expenditure on education as a percentage of GDP. Ireland is fairly balanced on all three indicators.

Poland, Italy, and the Czech Republic are in the fourth group, with low levels of both teachers' salaries and government expenditure on education. The last group includes Slovakia, Lithuania, and Hungary, which have low values for all indicators. For the indicator of education spending per student in primary education, most of the selected countries are above the decile value of 5. Only Lithuania and Hungary have a lower value. The United Kingdom cannot be ranked on this index because the relevant data on teachers' salaries are not available.

Fig. 2. Index of finance - groups of countries by results (circled)



Source: own elaboration, based on data by World Bank (2023) and OECD (2023a, 2023b).

Comparing the results of the index of finance (Fig. 2) with the combined PISA 2018 and TIMSS 2015 (Grade 4) index (Fig. 1) for this sample of coun-

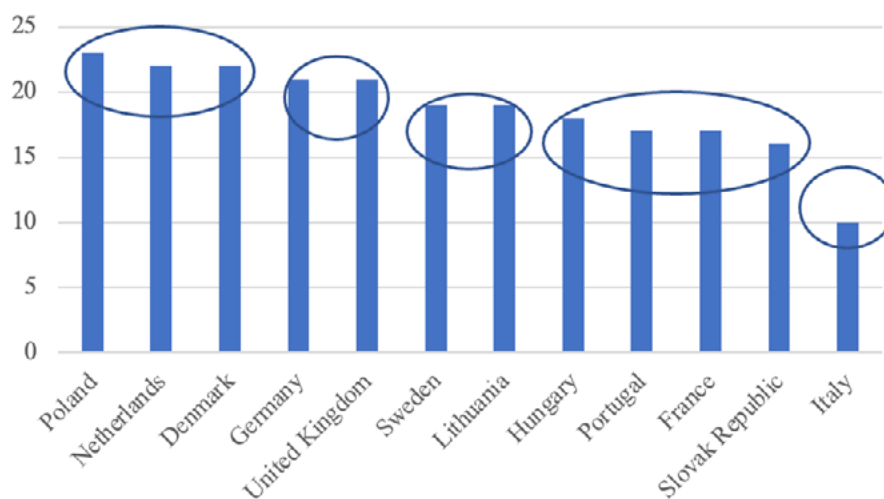
tries, the following observations are described. It shows that the impact of funding (as measured by the index of finance) is not clear-cut. There is a group of countries where “Provide more to improve gains” is confirmed. These are Sweden, Denmark, the Netherlands, Germany, and Finland, which are among the top countries in the sample, in terms of both financing and learning outcomes. On the contrary, the weaker countries in terms of both financing and learning outcomes are Slovakia, Lithuania, and Italy. But, importantly, there are also countries where “Provide more to improve gains” does not apply. This group includes, for example, Poland, which performs very well in international comparative surveys, in terms of learning outcomes (ranked third in the combined PISA and TIMSS index), but has a somewhat lower level in the index of finance. The Czech Republic, with a lower index of finance, also achieves relatively better learning outcomes. On the other hand, France, with a slightly higher level of the funding index, has weaker learning outcomes.

It can be concluded, for example, that the share of government spending on education plays an important role in stimulating economic growth, as noted by Di Lupidio (2019). However, this is not the only indicator suggesting the possibility of successful reform of the education system and its good performance. The examples of the Netherlands, Denmark, and Germany also confirm the important role of adequate financial remuneration of teachers.

The results of the index of educational well-being, based on the methodology used, are as follows (also see Fig. 3). The first group consists of Poland, the Netherlands, and Denmark. Poland is in the lead, despite a relatively low proportion of teachers working part-time. For the Netherlands, on the other hand, the high value of this indicator compensates for the lower level of the other two indicators (teacher-student ratio; teachers by age). The second group consists of Germany and the United Kingdom. Germany has average values for all three indicators, and the United Kingdom has the lowest proportion of teachers out of the fifty countries surveyed. The third group includes Sweden and Lithuania, where the low proportion of part-time teachers compensates for the other two indicators. The fourth group consists of Hungary, Portugal, France, and Slovakia. Hungary and Portugal are characterised by a low proportion of part-time teachers, but also by an average number of pupils per teacher. France and Slovakia have a low proportion of teachers aged over 50, and a relatively high average number of pupils per teacher (France has the highest of all these countries). The last group is Italy, which has average values for the number of pupils per teacher, but very low values for the other two indicators.

Finland and Czech Republic are not included in the index as no data are available for share of part-time teachers.

Figure 3. Index of education well-being – groups of countries by results (encircled)



Source: own elaboration based on data by OECD (2023c, 2023d) and Eurostat (2023).

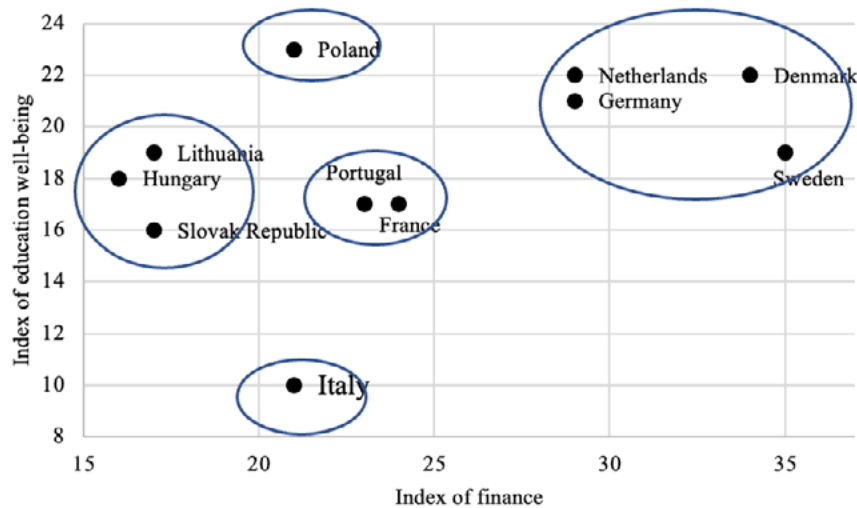
Comparing the results of the index of education well-being (Fig. 3) with the combined PISA 2018 and TIMSS 2015 (Grade 4) index (Fig. 1), shows a correlation between the value of this index and the learning outcomes in international comparisons. In line with the European Commission et al. (2021), it is evident that the environment plays an important role in the implementation of the educational process. Somewhat contrary to the work of Koc and Çelik (2015), the indicator of student per teacher ratio does not show a significant correlation with learning outcomes in all countries except Poland, which has the lowest number of pupils per teacher.

The position of Czech Republic in the index of education well-being cannot be determined precisely because of the lack of data on part-time teachers, although part-time employment in education does exist in the Czech Republic. With regards to the other indicators of the index of education well-being, the Czech Republic is one of the weaker countries in terms of students per teacher ratio, and the share of teachers aged over 50 years places it in the middle of the ranking of the selected countries.

Comparing the results of the two indexes (see Fig. 4), it can be seen that the selected countries can, basically, be divided into five groups: (1) a group of countries with higher values of both indexes, as in the Netherlands, Denmark, Germany, and Sweden; (2) a group of countries with medium values of both indexes, as in Portugal and France; (3) a group of countries with low values of the index of finance and medium values of the index of education well-being, as in Lithuania, Hungary, and the Slovak Republic. The last two groups consist of only one country each: (4) Poland, with a medium value of

the index of finance but the highest value of the index of education well-being; and (5) Italy, with a medium value of the index of finance but a significantly lowest value of the index of education well-being.

Figure 4. Index comparison



Source: own elaboration based on data by OECD (2023a, 2023b, 2023c, 2023d), Eurostat (2023) and World Bank (2023).

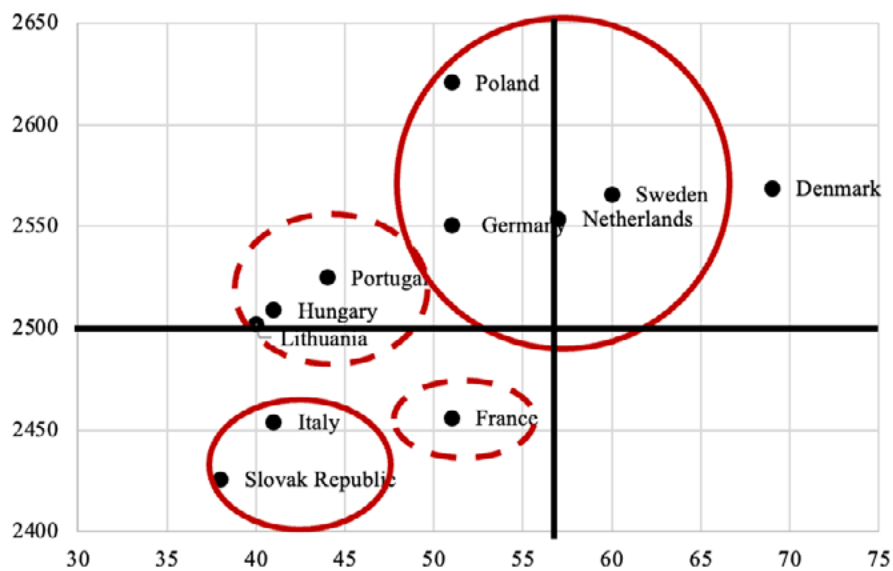
Discussion and recommendations

Looking at the overall results of the two indexes (the sum of their values) and contrasting them with the results in international comparisons of learning outcomes, the situation is illustrated in Fig. 5. These are the “Provide more to improve gains” countries: Denmark, Sweden, the Netherlands, Germany, and Poland. Poland, with the best learning outcomes in this group of countries, has a lower score on the index of finance, but this is compensated for by the highest score on the index of education well-being. The second group, “Provide less and diminish gains” countries include Italy and Slovakia. It is interesting to note the position of France (a “Provide less and diminish gains” country), which reaches the same value as Poland and Germany in the sum of the indexes, but the learning outcomes are weaker; this is mainly influenced by the learning outcomes in TIMMS. The last group, which can be described as “Provide more to improve gains” countries, consists of Portugal, Hungary, and Lithuania. The values of both indexes are at a lower level, but the learning outcomes are better, compared to France or Italy and Slovakia.

Looking at the overall results, according to the European Commission et al. (2022), countries with primary and lower secondary education systems of the 'single structure' type (Sweden, Denmark, Poland) are the best performers in this study. However, this type of education system also includes, for example, Portugal, which is in the average group, or the Balkan countries, which, although not part of the selected group of countries, are not among the successful countries in international comparisons of learning outcomes. The system of 'differentiated branches/tracks', implemented by the Netherlands and Germany can also be described as successful. Less successful are the 'common core curriculum' systems that are implemented in Italy and France, and the specific system that is implemented in the Czech Republic, Slovakia, and Hungary.

With regards to the necessary and constantly discussed reform of the education system in the Czech Republic it is, therefore, not possible to recommend one of the models unequivocally. As Kučerová et al. (2020) point out, the model should be based, primarily, on the country's own social, economic, and cultural contexts. It is appropriate to draw inspiration from countries that are successful in international comparisons of learning outcomes (for example, Poland or the Nordic countries), but the applicability of some best practices, in the context of different conditions, needs to be taken into account.

Fig. 5. Comparison of indexes and learning outcomes



Source: own elaboration based on data by OECD (2019, 2023a, 2023b, 2023c, 2023d), Eurostat (2023), World Bank (2023), and Martin et al. (2016a, 2016b).

An analysis of educational systems across the European Union reveals significant disparities in key areas such as funding and teachers' working conditions when compared to the most successful countries. And shifts are occurred. In the Czech Republic, for instance, teachers' salaries have seen a gradual increase since 2021. Despite this progression, Czech teachers' salaries remain below the EU average. Comparable initiatives have been observed in other EU nations; Lithuania, Romania, and Bulgaria have implemented substantial salary increases for teachers over the past decade, albeit from a lower baseline.

Regarding the educational environment, the student-to-teacher ratio varies considerably across EU countries. For example, Latvia, Sweden, and Italy report low ratios, whereas Malta, Austria, and Spain high ones. The Czech Republic positions itself between these extremes but faces challenges related to an ageing teaching workforce and the necessity to make the profession more appealing to younger individuals. Similarly, Estonia, despite achieving outstanding educational outcomes, contends with issues such as low teacher salaries and significant workloads.

Effective educational reform requires a strategic, long-term approach with well-coordinated steps. Estonia serves as an exemplary model, having combined school autonomy, a focus on digital education, and robust teacher support to attain notable success. The Czech Republic could draw valuable lessons from such approaches in formulating its own educational reforms.

Based on the results of this study, the following conclusions/recommendations can be drawn for the Czech Republic and also other European countries:

1. The Czech Republic shows a lower level of Government expenditure on education as share (%) of GDP. While all political representations declare education as their priority, the share of education expenditure in GDP has not increased over the long term. Although a strong correlation between education spending and performance in international comparisons of learning outcomes cannot be clearly identified (see the example of Poland), it would still be advisable, if the government really considers education a priority, to reflect on the allocation of funds to education around the EU.
2. The Czech Republic also has lower teacher salaries than most of the selected countries. Fortunately, teacher salaries in the country have been gradually increasing since 2021, which is crucial. Adequate remuneration plays a very important role in making the profession more attractive and many countries of EU struggles in this. Financial attractiveness provides teachers with stronger incentives and much-needed financial security and can help to attract/retain more quality staff in educational systems.

Therefore, the level of teacher salaries in education must be maintained over the long term.

3. The position of the Czech Republic in the index of education well-being could not be precisely determined, due to the lack of data on part-time teachers. These data need to be monitored and evaluated over the longer term. There is also a need to monitor data on the ageing of the teaching workforce, and to take appropriate measures to attract young people into the sector. The Czech Republic is one of the weaker countries in terms of students per teacher ratio, because the educational process takes place in classrooms with a higher number of students. In order to achieve a higher degree of individualisation in the educational process, the number of students per teacher needs to be reduced, as shows evidence from more successful educational systems. Improving the conditions of the educational process around the EU, in addition to salary levels, can have a positive impact on candidates' interest in the teaching profession, their qualifications, and their skills.

The question is whether greater autonomy in education, which the majority of countries in the most successful group (typically the Nordic countries of Finland, Denmark, or Sweden) have, is a realistic model with which the Czech Republic can reform its education system. Poland, for example, has opted for a “single structure” system, which is closer to the Czech system, and this country is successful in international comparisons.

Experiences from high-performing EU countries such as Estonia, Finland, and the Netherlands show that strong education systems rely on professional teachers, school autonomy, stable funding, and coherent curricula. However, transferring these strategies to lower-performing countries like the Czech Republic, Romania, or Bulgaria is constrained by differing social, economic, and institutional conditions. Despite these challenges, selected elements—such as long-term investment in teachers, greater school autonomy, and supportive leadership—can be successfully adapted if contextually tailored. At the end of day, the key lies not in replication, but in thoughtful adaptation to local needs and capacities.

The political implications arising from this paper and broader comparative analyses of education systems in the EU demonstrate that improving educational outcomes requires more than simply increasing financial investment; it demands targeted and strategic use of resources within a coherent institutional framework. Countries such as Finland, the Netherlands, and Denmark illustrate that effective systems are built on a combination of school autonomy, strong professional support for teachers, and flexible, competence-based curricula. Policymakers should therefore prioritise:

1. Multi-year, stable, and growth-oriented funding frameworks;

2. Enhancing the attractiveness of the teaching profession through competitive salaries, career development pathways, and targeted support for early-career teachers;
3. Establishment of intermediary governance bodies (e.g., regional support agencies) to assist schools;
4. Curricular reform focused on key competencies and adaptability; and
5. Systematic promotion of teacher well-being and improvements to the physical and organisational teaching environment.

Additionally, access to high-quality educational data and the cultivation of a constructive evaluation culture should be standard practice. All these measures require cross-sectoral coordination, policy continuity, and a commitment to positioning education as a long-term, cross-partisan priority, which is often the critical point.

Conclusions

Education is important for the future of a country, its economic performance, and for individuals. Primary education has a special role to play (see, for example, Laal and Salamati, 2012; Becker 1993; Kameníček 2012) as it is the beginning of each individual's educational journey.

The aim of this paper is to identify and assess the factors that are key to good educational outcomes in primary schools, based on the results of selected countries in the international PISA and TIMSS surveys, and their correlations with selected system characteristics. In view of the ongoing discussion about the need for educational reform in the Czech Republic, the partial aim of this paper is to assess its position, identify the differences of the Czech Republic education system, and formulate conclusions in relation to the preparation of educational reform.

This paper compares the performances of education systems in selected EU countries, using two indexes: index of finance, and index of education well-being. These simply describe both the financial provision and the environment in which the educational process takes place. This paper does not deal with the student and his/her social background.

Due to the methodology that was used in the present study, the index of finance does not fully support the "Provide more to improve gains" principle. This means that the study automatically does not follow the hypothesis that countries which are willing to invest more in education perform better in international comparisons. Looking at the index of education well-being which, essentially, reflects the working environment for teachers, the results are more pronounced. A better environment for the learning process (as measured by selected indicators) is associated with better results in international comparisons.

Given that both indexes are based on a limited number of indicators, it is important to bear in mind, when interpreting the results, that many other factors are involved in the reality of the educational process. These are determined not only by the historical, political, economic, and social development factors, but also, for example, by the institutional or cultural development factors of a given country.

The authors are aware of certain limitations of the results of this paper due to the methodology used to calculate the indexes; choosing a different methodology could lead to different results. Nevertheless, the methodology used here can contribute to the discussion on education, especially primary education, and its financing in relation to the results of the international comparisons of PISA and TIMMS.

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References

- Aulbur, W., & Singh, H.V. (2014). Next Gen Manufacturing: Industry 4.0. A look at the changing landscapes in manufacturing. *Theme Paper. Confederation of Indian Industry*. Retrieved from: <https://www.gita.org.in/Attachments/Reports/CII%20Roland%20Berger%20Industry%2040.pdf>
- Bassi, M., Meghir, C., & Reynoso, A. (2020). Education quality and teaching practices. *The Economic Journal*, 130(631), 1937-1965. Retrieved from: <https://doi.org/10.1093/ej/ueaa022>
- Becker, G.S. (1993). Nobel Lecture: The Economic Way of Looking at Life. *Journal of Political Economy*, 101(3), 385-409. Retrieved from: <http://www.jstor.org/stable/2138769>
- Berger, T., & Frey, C. (2016). Structural Transformation in the OECD: Digitalisation, Deindustrialisation and the Future of Work. OECD Social, Employment and Migration Working Papers, No. 193, *OECD Publishing*, Paris. Retrieved from: <http://dx.doi.org/10.1787/5jlr068802f7-en>
- Berk, J., & Weil, D. (2015). Old Teachers, Old Ideas, and the Effect of Population Aging on Economic Growth. *Research in Economics*, 69(4), 661-670. Retrieved from: <https://doi.org/10.1016/j.rie.2015.07.002>
- Busemeyer, M.R., & Garritzmann, J.L. (2017). Academic, vocational or general? An analysis of public opinion towards education policies with evidence from a new comparative survey. *Journal of European Social Policy*, 27(4) 373– 386. Retrieved from: <https://doi.org/10.1177/09589287177287>
- Di Lupidio, V. (2019). *How does government expenditure on education and specific reforms in education affect economic growth? Evidence from OECD countries and policy implications* [Master's thesis, Université catholique de Louvain].
- Darling-Hammond, L., Bastian, K., Berry, B., Carver-Thomas, D., Kini, T., Levin, S., & McDiarmid, W. (2019). *Educator supply, demand, and quality in North Carolina: Current status and recommendations*. Palo Alto, CA: Learning Policy Institute.

- Drucker, P. F. (1994). *Věk diskontinuity: Obraz měnící se společnosti [The age of discontinuity: Guidelines to our changing society]* (P. Medek, Trans.). Prague: Management Press. (Original work published 1969)
- Dudok, F. (2019). Comparing the education systems of Central-Eastern European countries -policies and curricula. *Journal of Applied Learning & Teaching*, 2(Special Issue 1), 50-63. DOI:10.37074/jalt.2019.2.s1.9.
- Eriksson, K., Helenius, O., & Ryve, A. (2019). Using TIMSS items to evaluate the effectiveness of different instructional practices. *Instructional Science*, 47(1), 1–18. Retrieved from: <https://doi.org/10.1007/s11251-018-9473-1>
- European Commission, EACEA, & Eurydice (2020). *Structural indicators for monitoring education and training systems in Europe – 2019*. Luxembourg: Publications Office of the European Union.
- European Commission, EACEA, & Eurydice (2021). *Teachers in Europe: Careers, Development and Well-being*. Luxembourg: Publications Office of the European Union.
- European Commission, EACEA, & Eurydice (2022). *The structure of the European education systems 2022/2023: schematic diagrams*. Luxembourg: Publications Office of the European Union.
- European Commission, EACEA, & Eurydice (2023). *The structure of the European education systems 2023/2024: schematic diagrams*. Luxembourg: Publications Office of the European Union.
- European Commission, Directorate-General for Education, Youth, Sport and Culture (2024). *Education and training monitor 2024: Comparative report*. Luxembourg: Publications Office of the European Union.
- Eurostat (2023). *Teachers working part-time as a percentage of all teachers, by education level, 2013–2020 [Data set]*. Retrieved from: https://ec.europa.eu/eurostat/databrowser/view/educ_uoe_perd05
- Gleason, N.W. (Ed.). (2018). *Higher education in the era of the Fourth Industrial Revolution*. Singapore: Palgrave Macmillan.
- Gorur, R. (2016). Seeing like PISA: A cautionary tale about the performativity of international assessments. *European Educational Research Journal*, 15(5) 598-616. Doi: 10.1177/1474904116658299
- Hanushek, E.A., & Woessmann, L. (2007). *The role of education quality for economic growth* (Policy Research Working Paper No. 4122). Washington, DC: World Bank.
- Hanushek, E.A., Link, S., & Woessmann, L. (2013). Does school autonomy make sense everywhere? Panel estimates from PISA. *Journal of Development Economics*, 104, 212-232. Retrieved from: <https://doi.org/10.1016/j.jdeveco.2012.12.002>
- He, Q., von Davier, A. A., Greiff, S., Steinhauer, E. W., & Borysewicz, P. B. (2017). Collaborative problem solving measures in the Programme for International Student Assessment (PISA). In A. A. von Davier, M. Zhu, & P. C. Kyllonen (Eds.), *Innovative assessment of collaboration* (pp. 95–111). Cham: Springer.
- Hopfenbeck, T.N., Lenkeit, J., El Masri, Y., Cantrell, K., Ryan, J., & Baird, J. (2018). Lessons Learned from PISA: A Systematic Review of Peer-Reviewed Articles on the Programme for International Student Assessment. *Scandinavian Journal of Educational Research*, 62(3), 333-353. Doi: 10.1080/00313831.2016.1258726.
- Chalkiadaki, A. (2018). A Systematic Literature Review of 21st Century Skills and Competencies in Primary Education. *International Journal of Instruction*, 11(3), 1-16. Retrieved from: <https://doi.org/10.12973/iji.2018.1131a>

- Cho, J., & Baek, W. (2019). Identifying Factors Affecting the Quality of Teaching in Basic Science Education: Physics, Biological Sciences, Mathematics, and Chemistry. *Sustainability*, 11(14), 3958. Retrieved from: <https://doi.org/10.3390/su11143958>
- Kameníček, J. (2012). *Lidský kapitál: Bohatství, které dřímá v nás* [Human capital: Wealth lies within us] (2nd ed.). Prague: Karolinum.
- Koc, N., & Çelik, B. (2015). The impact of number of students per teacher on student achievement. *Procedia - Social and Behavioral Sciences*, 177, 65–70. Retrieved from: <https://doi.org/10.1016/j.sbspro.2015.02.335>
- Kučerová, S. R., Meyer, P., & Trahorsch, P. (2020). Factors influencing elementary education systems in selected European countries. In C. Cristy, L. Hargreaves, & S. R. Kučerová (Eds.), *Educational research and schooling in rural Europe* (pp. 49–66). Charlotte, NC: Information Age Publishing.
- Laurie, R., Nonoyama-Tarumi, Y., Mckeown, R., & Hopkins, C. (2016). Contributions of Education for Sustainable Development (ESD) to Quality Education: A Synthesis of Research. *Journal of Education for Sustainable Development*, 10(2), 226–242. Retrieved from: <https://doi.org/10.1177/0973408216661442>
- Mankiw, N.G. (2001). *Principles of macroeconomics*. 2nd edition. Fort Worth: Harcourt College.
- Laal, M., & Salamati, P. (2012). Lifelong learning: why do we need it? *Procedia - Social and Behavioral Sciences*, 31, 2012, 399-403, Retrieved from: <https://doi.org/10.1016/j.sbspro.2011.12.073> .
- Martin, M. O., Mullis, I. V. S., Foy, P., & Hooper, M. (2016). *TIMSS 2015 international results in science (Grade 4)*. International Association for the Evaluation of Educational Achievement. Retrieved from: <https://timss2015.org/wp-content/uploads/filebase/full%20pdfs/T15-International-Results-in-Science-Grade-4.pdf>
- Mullis, I. V. S., Martin, M. O., Foy, P., & Hooper, M. (2016). *TIMSS 2015 international results in mathematics*. International Association for the Evaluation of Educational Achievement. Retrieved from: <https://timssandpirls.bc.edu/timss2015/international-results/wp-content/uploads/filebase/full%20pdfs/T15-International-Results-in-Mathematics.pdf>
- Mullis, I. V. S., & Martin, M. O. (2012). Using TIMSS and PIRLS to improve teaching and learning. *Recherches en éducation*, (14). Retrieved from: <https://journals.openedition.org/ree/5835>
- Národní ústav vzdělávání. (2015). *Nová klasifikace ISCED 2011* [New ISCED classification 2011]. Retrieved from: <https://archiv-nuv.npi.cz/isced.html>
- OECD (2014) Education Policy Outlook: France. Retrieved from: www.oecd.org/education/policyoutlook.htm
- OECD (2015) Education Policy Outlook: Hungary.
- OECD (2016) Education Policy Outlook: Slovenia.
- OECD (2019). *School leadership for learning: Insights from TALIS 2018*. Paris: OECD Publishing.
- OECD (2017) Education Policy Outlook: Austria.
- OECD (2019). *PISA 2018 results: Combined executive summaries (Volumes I–III)*. Paris: OECD Publishing.
- OECD. (2022). *Education at a glance 2022: OECD indicators*. Paris: OECD Publishing.
- OECD (2023b). *Teachers' salaries* [Indicator]. Retrieved from: <https://data.oecd.org/teachers/teachers-salaries.htm>
- OECD (2023c). *Students per teaching staff* [Indicator]. Retrieved from: <https://doi.org/10.1787/3df7c0a6-en>

- OECD (2023d). *Teachers by age* [Indicator]. Retrieved from: <https://doi.org/10.1787/93af1f9d-en>
- OECD (2024). *Education at a glance 2024: OECD indicators*. Paris: OECD Publishing.
- Patrinos, H. A., & Angrist, N. (2018). *Global dataset on education quality: A review and update (2000–2017)* (Policy Research Working Paper No. 8592). Washington, DC: World Bank.
- Peková, J., Jetmar, M., & Toth, P. (2019). *Veřejný sektor, teorie a praxe* [Public sector, theory and practice]. Prague: Wolters Kluwer.
- Petrică, M. (2023). Comparative Analysis of European Education Systems: Exploring Differences in Educational Structures, Policies, Practices, and Their Impacts on Student Outcomes. *Research and Advances in Education*, 2(8), 30–46.
- PwC. (2024). *AI jobs barometer* [Report]. Retrieved from: https://www.pwc.com/hu/hu/sajtoszoba/assets/ai_jobs_barometer_2024.pdf
- Rogošić, S., & Baranović, B. (2016). Social capital and educational achievements: Coleman vs. Bourdieu. *Center for Educational Policy Studies Journal*, 6(2), 81–100. Retrieved from: <https://doi.org/10.26529/cepsj.89>
- Scheunpflug A (2021) Global learning: Educational research in an emerging field. *European Educational Research Journal*, 20(1), 3-13. Retrieved from: <https://doi.org/10.1177/1474904120951743>
- Vera-Toscano, E. (2013). *Public financing of education in EU countries: A cross-country systematic analysis*. Luxembourg: Publications Office of the European Union.
- Virtanen A, De Bloom J and Kinnunen U (2020) Relationships between recovery experiences and well-being among younger and older teachers. *International Archives of Occupational and Environmental Health*, 93, 213–227, Retrieved from: <https://doi.org/10.1007/s00420-019-01475-8>
- World Economic Forum (WEF) (2016). *The future of jobs: Employment, skills and workforce strategy for the Fourth Industrial Revolution* [Global Challenge Insight Report]. Retrieved from: https://www3.weforum.org/docs/WEF_Future_of_Jobs.pdf
- Wiberg M (2019) The relationship between TIMSS mathematics achievements, grades, and national test scores. *Education Inquiry*, 10(4), 328-343.
- World Bank. (2023). *Government expenditure on education, total (% of GDP)* [Data set]. Retrieved from: <https://data.worldbank.org/indicator/SE.XPD.TOTL.GD.ZS>

