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Changes in educational inequalities in Poland. Comments on Zbigniew Sawiński's article "Education reform and inequality: fifteen years of new lower secondary schools in Poland"

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In his text published in *Edukacja*, *141*(2), 2017 („Education reform and inequality: fifteen years of new lower secondary schools in Poland"), Zbigniew Sawiński analyses data from the 2000 to 2012 editions of the OECD PISA study and argues that lower secondary school reform has not reduced educational inequalities in Poland. The importance of students' social origin remained at the same level as before the reform, the impact of social origin on the choice of type of secondary school remained the same, and an increasing differentiation of lower secondary schools did not lead to an increase in educational inequalities. I present methodological arguments and the results of a re-analysis of PISA data, indicating changes in wider educational inequalities. Between 2000 and 2012: (a) the strength of association in the performance of 15-year-olds with the socio-economic status of students' families did not change, but (b) the variation of results decreased, which was mainly due to the improved performance of the lowest performing students; (c) the differences between students of high and low socio-economic status decreased; (d) the influence of social origin on the choice of the type of upper secondary school decreased. The effects of socio-economic status on upper secondary school choice is largely direct: it is not mediated by the educational achievements of students. The commentary also highlights the complexity of lower secondary school reform, which was not limited to the introduction of such schools. I indicate the role of factors that make it difficult to interpret the results of the reform in causal terms – particularly the role of unobserved variables related to the changes in the learning environments of subsequent cohorts of students.

Keywords: school effectiveness; educational achievement; educational inequalities; school selection; social origin; educational pathways.

The article by Zbigniew Sawiński (2017) is an important contribution to the discussion about the consequences of the 1999 educational reform with regard to educational inequalities. The author stated three hypotheses, which he then verified on the basis of data from the OECD PISA study. The hypotheses relate to the dynamics of the relationship between family socio-economic status and student educational achievement, their secondary school choices and the relationship between educational inequality and changes in between-school variance in student

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performance. Sawiński claims that inequalities in Poland have not changed, which is evidenced by the similar correlation values between the indicator of socio-economic status and PISA scores. Sawiński devoted the second part of his article to analysing the relationship of between-school variance and educational inequalities. Here, he introduced new issues and cross-national comparisons, loosely related to the main question of the effects of introduction of of lower secondary schools on educational inequalities. The comparative aspects deserve separate consideration and will not be addressed in this polemic.

Two research traditions on educational inequalities

Zbigniew Sawiński referred to two traditions of researching inequality. The first involves the study of social stratification. The dominant view is that educational inequalities are persistent. The educational system can promote equal opportunities, but above all, it reproduces the existing order and social inequality. The thesis of the persistence of educational inequalities is firmly grounded in sociological theories and empirical research, which Sawiński correctly emphasises in his research review. He does not mention, however, that in the sociological literature of the last two decades, arguments have been made that the relationship between social origin and broadly understood educational achievement had weakened (see e.g. Breen, Luijkx, Müller and Pollak, 2009; Ganzeboom and Treiman, 2014; Marks, 2014). Furthermore, he makes no reference to the fact that the studies differ in the time horizon of the analyses, which often include decades, not years. Also educational inequalities are defined in a different manner: usually as the inheritance of educational or social status or the differences in the chances of passing subsequent educational transitions depending on one's social origin. According to this research tradition, the relationship between social origin and students' test results is rarely analysed.

The second tradition includes research on the consequences of changes in educational structures and institutions for educational inequalities. Several studies conclude that the organisation of the educational system affects social inequalities. Literature highlights various dimensions that differentiate educational systems (see e.g. Kerckhoff, 2001), such as: the centralisation of decision making on educational standards and curricula (standardization), differences in the organisation of teaching and streaming students into separate educational tracks (stratification) and the orientation of the educational system to the training of occupational skills (as opposed to teaching general skills). The consequences of different institutional arrangements are visible primarily in educational transitions and the transition to the labour market (Shavit and Muller, 1998). But their consequences for educational achievements are also analysed. Sawiński focused only on one dimension of differentiation: earlier or later tracking. As expected from the results of comparative studies, postponing the age of tracking is related to a weaker association between family socio-economic status (SES) and student achievement (see Betts 2011; Horn, 2009; Lavrijsen and Nicaise, 2015; Van de Werfhorst and Mijs, 2010). However, the age at tracking constitutes only one element of organising the educational system. Uniform, nationwide examinations are good example of another important mechanism that could affect educational inequalities (Bol, Witschge, Van de Werfhorst and Dronkers, 2014). Educational systems also differ in terms of school autonomy, the participation of the private sector or the ability of a student to choose a school, and thus – competition among schools. Each of these factors can strengthen or weaken educational inequalities. Particular dimensions of the differentiation of education systems are also interdependent.

For example, tests and exams have a stronger effect if schools have more autonomy and can respond to the incentives provided by test results (see: overview of research in: Hanushek and Woessman, 2011).

Sawiński did not describe the scope of changes introduced in Poland. The title and a reading of the article suggest that the reform was limited (through the introduction of lower secondary schools) to extending the period of universal, general secondary education by one year. However, the reform was a much more complex intervention, which – apart from restoring lower secondary schools – also included, among other things: the completion of the process of decentralisation, namely the transfer of responsibility for almost every school to municipalities and counties and the related change of the school funding model, changes in the professional advancement of teachers and the introduction of external examinations. Therefore, the observed effects of the reform are the net effects of all changes made. Emphasising the effects of the introduction of lower secondary schools seems logical. General education was extended by one year, which could be highly significant, particularly for those students who in the previous system would have chosen education in basic vocational schools. These students benefited the most from the reform, because in the "old system" they would have had less mathematics, Polish language and science classes (Jakubowski, Patrinos, Porta and Wiśniewski, 2016). This explanation sounds convincing. Many studies have confirmed that an early start in education, the extension of the school year or the number of years of compulsory education, can bring greater benefits for disadvantaged groups (see: e.g. research overview in Raudenbush and Eschman, 2015). Still, the mechanism and its implications for educational inequalities are complex and not so obvious. Therefore, it cannot be said that the observed relationships provide sufficient evidence of the effects of only the restoration of lower secondary schools.

The complexity of the education reform and the difficulty in separating the effects of particular changes is not the only problem. According to Sawiński, the major difficulty in interpreting the impact of reforms is the distinction between changes in educational inequalities and changes in the level of social inequality. Sawiński recalled this concept vaguely, presenting the Gini index of income inequalities and the differences in the value of the index in various countries in 2013–2014. However, presenting the value of this index at one particular point in time does not explain much. Income inequality has changed significantly in Poland. By comparing the performance of students born in 1984–1996[1], Sawiński assumed that the only difference between these students is that some of them experienced education in lower secondary schools, while others were still educated in the old school system. Still, the studied cohorts differed, both with respect to the variables controlled in the PISA study (e.g. the SES of the student's parents) and the unobserved variables. The problems relating to interpreting changes over time are well illustrated by the framework of the dynamic development of skills proposed by James Heckman and colleagues (Cunha and Heckman, 2007; 2009; Heckman and Mosso, 2014; cf. Raudenbush and Eschmann, 2015). The skills of fifteen-year-olds accumulate the effects of learning in different periods of life, both in the family and in the wider environment – including educational institutions – and the process of skill acquisition depends on earlier developmental differences. Such differences are shaped not only by socio-economic status, but also other environmental factors that are in varying degree related to

[1] The PISA study surveys fifteen-year-olds. In the years 2000–2012 the study covered cohorts born in 1984, 1987, 1990, 1993 and 1996.

SES. Thus, attributing individual differences only to lower secondary schools seems to be an oversimplification. This is because changes would be disregarded relating to the effects of educational processes in the family and other learning environments, as well as changes occurring in preschool and school education over the last 20 years unrelated to the introduction of lower secondary schools.

What are educational inequalities?

Sawiński adopted a narrow understanding of educational inequalities, which does not reflect its multidimensional nature. The problem of inequality was limited to a correlation between the parental SES and the level of students' skills, and in the case of the selection of the upper secondary level – to the correlation between parental education and choice of school. This approach seems logical and is consistent with the tradition of social stratification research: correlation coefficients provide an answer to the question of how children's social position is correlated with the social status of their parents. In the case of Sawiński's analyses, correlation coefficients answer questions about the extent to which student performance or choice of school can be predicted by information on the parents' SES. However, this is not the only, and definitely not the most important perspective on educational inequalities. The value of the correlation coefficient does not indicate whether and how the performance of students with high and low family socio-economic status differs or the variability of their results. We expect that students with low SES will achieve poor results, and students with high SES – better results, but the correlation coefficient does not provide information on this. A complete picture of inequalities requires insight into the variability of student skills. This is why a number of publications report the indicators of variability, e.g. the differences between percentiles (see: e.g. OECD, 2013; UNICEF, 2016). The issue of the differentiation of student performance was mentioned in Sawiński's article, but only in the context of the discussion on between-school variance and its relationship to educational inequality. This is quite surprising, as the decrease in the number of poor-performing students and the improvement of average results of Polish students in general has been widely commented.

Changes in educational inequalities between 2000 and 2012: parental SES and the performance of fifteen-year-olds in the PISA study

Between 2000 and 2012, we observed not only an increase in the average results of successive cohorts of Polish fifteen-year-olds in the PISA test, but also a reduction in variation of performance. Sawiński mentioned these improvements, but did not comment on the changes in the variability of the results and failed to see the connection between this improvement and changes in educational inequality.

Changes in the performance of fifteen-year-olds from 2000 to 2012 are illustrated by the descriptive statistics presented in Table 1. The data refer only to the results in reading, as only this domain may be legitimately compared beginning from the year 2000. In the 2003 edition of PISA, the definition of mathematical literacy changed, and from 2006 – the definition of science literacy. The comparison of results in mathematics and science from 2000 and subsequent editions of PISA is, therefore, unwarranted. The differences between the median and the 10th and 90th percentile show that the variation of student performance decreased on both sides of the distribution, and to a greater extent – between the weakest students and the median. So the improvement in the average performance of successive cohorts of students was accompanied by a reduction

of differences between students. It is worth taking a look at similar data on changes in the synthetic index of economic, social and cultural status (ESCS) calculated by OECD. Its value has increased, which shows the relative improvement of this index in Poland compared to the OECD average. However, there is no clear trend in its variation. This means that the average socio-economic status in Poland improved (e.g. the average level of parents' educational attainment increased, parents have more prestigious occupations, household wealth increased, as well as their home possessions), but there were no significant changes in the dispersion of SES.

By analysing the relationship between social origin and students' performance in the PISA test, Sawiński assumed that it was linear. He calculated the correlations for each edition of the study, compared the confidence intervals of the estimates and found that there were no grounds to reject the hypothesis that the impact of origin on school performance was the same before and after the reform. In a narrow sense, in which the impact of origin on performance is understood as the strength of the relationship between these two variables, this is indeed the case. A more complex picture can be obtained by looking at the different dimensions of inequality.

A simple and convenient tool for the analysis of inequality is the analysis of regression. It allows us to evaluate not only the strength of the relationship between socio-economic status, but also to determine the level of students' skills and the slope of the regression curve, which illustrates the differences between students with a low and high levels of SES (see: Willms, 2003). I also included additional information in the analyses: the grade attended by a student and his or her sex. Information about the grade is of particular importance. In all editions of the study, the population was defined in the same manner: those who were 15 years old. However, in the Polish edition of the study in 2000, only students from the first year of different types of schools functioning before the reform of 1999 participated in the study: general upper secondary schools, vocational upper secondary schools and basic vocational schools. Students repeating a grade or those "delayed" in relation to the modal grade due to other reasons were still in primary school and did not participate in the PISA test (the fact that

Table 1

Changes in the level and dispersion of reading performance, and changes in the value of the ESCS indicator in 2000–2012 as measured by the mean, standard deviation, and the differences between selected percentiles

PISA Results	Indicator	Year of study				
		2000	2003	2006	2009	2012
	M	479.1	496.6	507.6	500.5	518.2
	SD	99.8	95.9	100.2	89.2	87.3
Reading	Difference P90–P10	260	242	259	230	222
	Difference P50–P10	144	127	139	122	118
	Difference P90–P50	117	115	121	108	104
	M	-0.62	-0.41	-0.57	-0.30	-0.21
	SD	0.84	0.92	0.83	0.81	0.90
ESCS	Difference P90–P10	2.25	2.42	2.27	2.15	2.35
	Difference P50–P10	0.82	0.88	0.80	0.67	0.80
	Difference P90–P50	1.43	1.54	1.46	1.48	1.55

this might be source of bias in comparisons with subsequent editions of the PISA study was mentioned in the Polish report from the study; see: Haman, 2004). In the PISA 2003 edition, the vast majority of respondents were students of the third year of lower secondary school, but fifteen-year-olds attending lower grades of lower secondary school and a small number of students from upper secondary schools were also surveyed. The number of fifteen-year-olds studying in first or second year of lower secondary school was not high (approx. 4–5%), but they achieved a lower score than students studying in the third year (in 2003, this was up to 153 points on the PISA scale, in 2012 – approx. 108 points). Sex is also an important predictor of student performance, so the inclusion of this variable helps to reduce the error in the estimates of the SES effect.

I transformed ESCS for each PISA edition into z-score. This helped to avoid the problem of distinguishing between the impact of changes in the value and distribution of SES. It should be also noted that for the purposes of analysis, I assumed that the reliability of the ESCS index had not changed over time. Low reliability reduces the correlation coefficient, so the differences in reliability over time may result in over- or underestimating the effects obtained in the statistical analyses. The issue of modelling the ESCS index, and therefore the relationship between the index of household possessions and the occupational status and education of parents was also ignored (an interesting analysis of this issue can be found in Pokropek, Borgonovi and Jakubowski, 2015, but their analyses are limited to comparisons between countries, not comparisons over time).

To facilitate a comparison between the years, an analysis was conducted on the pooled data of all PISA editions. Since the regression took into account the interaction between particular editions and the year of the study, as well as the interaction between all other variables with the survey edition, the results are equivalent to the regressions for particular years. The models assume a constant variance in the different editions of the PISA study. The use of the feasible generalised least squares (FGLS) model, which take into account the heteroscedasticity of the variance, shows little difference in the estimates of standard errors of parameters in relation to OLS regression.

The answer to the question concerning the change of the strength of the relationship between SES and student performance is given by the interaction effect of the ESCS index and year of study (changes in the slope of the regression curve) – a steeper curve means a greater effect of SES on student performance. The results are shown in the appendix (Table A1).

Regression models calculated for each edition of the PISA study confirmed the conclusions made by Sawiński relating to the correlation between parental SES and student performance. Estimates of the effects of ESCS for each edition are statistically indistinguishable. This conclusion is not affected by the slight deviation from the linearity of the relationship between the results of PISA and ESCS (as evidenced by significance of the quadratic term of ESCS). Still, the results of analyses of the combined PISA data sets (see: Table A1 in the appendix) provide additional information. First, between 2000 and 2012, significant changes in the level of students' performance were observed. If we assume that the level of skills is important in accessing higher levels of education, enables a person be more competitive in the labour market or function better in social and civic life, this fact is significant in terms of educational and social inequalities. Second, the improvement was greater among students with lower SES. The change is negligible and the estimates and their error is sizeable, but there is a visible linear trend. Therefore, it may be concluded that between 2000 and 2012, the performance of students

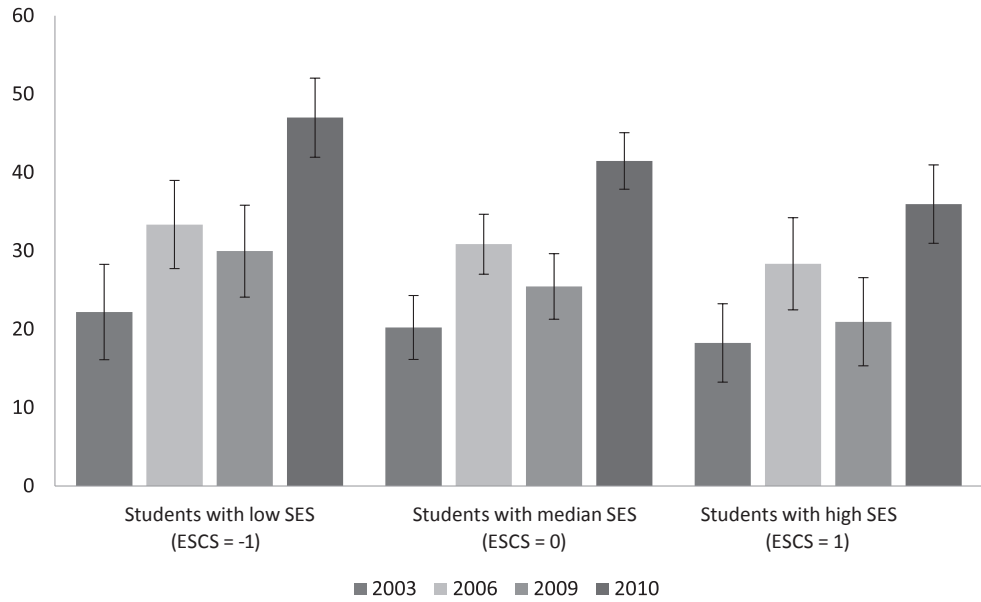

Figure 1. Average marginal effects from the linear regression model (differences from the year 2000 in points on the PISA scale) for students with different levels of SES in the modal grade.

The figure also shows 95% CI. Estimates are calculated from the model 3 shown in Table A1 and are for the modal grade (in the year 2000, this was the first year of secondary school, in 2003–2012 – the third year of lower secondary school).

with lower SES improved more than the performance of students with higher SES. This is well illustrated by the marginal effects (Figure 1). Worth noting is also the importance of using information on student's grade: students repeating a grade were not covered by PISA 2000 study not only overestimated student performance, but also underestimated the SES effect in 2000.

Between-school variance of students' performance

The changes that have taken place between 2003 and 2012 can be analysed more precisely. The PISA study was conducted according to a similar scheme, and covered students attending the same type of school – lower secondary school. Multilevel modelling allows to estimate the variation in student performance separately for the part relating to the differences between schools and the part relating to the differences between students. Hypothesis 3 from Sawiński's article refers to this type of analysis. He states that "the increasing differences between the new lower secondary schools according to performance do not perpetuate the social inequality at this school level". The author verified this hypothesis using figures taken from the PISA report, which show changes in the between-school variance of PISA mathematics results in Poland (according to OECD's analyses, it increased from approx. 12 to 20.5% between 2003 and 2012), and the change of SES effects at the level of the school (an increase from approx. 26 to 36 points). Because the difference between the last two parameters is not statistically significant, Sawiński concluded that there were no grounds to reject the hypothesis.

In hypothesis 3, Sawiński defines educational inequalities in an unusual way – as

the effects of parental SES at the school level. Why is the focus exclusively on the effects at the school level, and not at the level of the students? This is an example of an inconsistent understanding of educational inequalities. It should be emphasised that the approach applied by OECD, in which the effects of SES are calculated at the level of the school, raises methodological doubts. According to Gary Marks (2015), taking into account the average school SES leads to inflated estimates of the effects of this parameter at the level of schools or even to statistical artefacts. It seems, therefore, that the use of PISA data is justified only in the case of analysing the differences in the effects of SES at the student level. PISA data are not good material for verifying this particular hypothesis.

The second problem, which Sawiński has not noticed – and which is usually not mentioned in the Polish discussion on between-school variance – is disregarding the issue of the overall variation of student performance. Examination data is more suitable for an analysis of the changes in between-school variance than PISA results (see: e.g. Dolata, Jasińska and Modzelewski, 2012). However, examination data is not comparable over time, so it does not provide information about the changes of the overall variance of student performance. Meanwhile, one can imagine a scenario in which the overall variance in student performance increases and between-school variance decreases. The opposite can happen: a decrease of overall variance in performance could be accompanied by growing between-school variance. In the case of Polish PISA data on reading skills, the latter phenomenon is observed. The variance of results in mathematics decreased between 2003 and 2006, only to return in subsequent editions to a similar level as in 2003. Between-school variance of family socio-economic status is also worth noting. Schools vary considerably in terms of status resources, but between-school variance has not changed between 2003 and 2012 (Table 2).

Multilevel models confirmed the conclusions from the analysis of pooled PISA data from the 2000–2012 editions. The slope of regression changed over time and this relationship was not fully linear. The interaction term between grade repetition and SES is also

Table 2
Overall variance and between-school variance of the results of fifteen-year-olds attending lower secondary schools

	Year of study			
Indicator	2003	2006	2009	2012
Reading				
Total variance	9 651.7	10 301.7	8 260.8	8 230.5
% of variance explained by school	18.1%	16.4%	16.6%	25.2%
Mathematics				
Total variance	8 335.6	7 627	8 022.4	8 231.7
% of variance explained by school	14.9%	14.9%	17.8%	22.6%
ESCS indicator (non-standardized)				
Total variance	1.29	1.16	1.11	1.25
% of variance explained by school	38%	37%	37%	39%

Estimates of the two-level model with random effects at the level of the school (the so-called empty model), taking into account replication weights at student and school levels and five plausible values. Data concerning fifteen-year-olds attending secondary schools were not included in the analyses.

significant: students with lower parental SES repeat a grade more often, even when performance is controlled[2].The advantage of multilevel modelling includes the possibility of analysing the change of variance when introducing individual variables (Rabe-Hesketh and Skrondal, 2012). The comparison of estimates of the variance in the empty model (containing no predictors, and allowing for the estimation of variance components, and a model in which ESCS is the predictor, showed that in 2003, differences in SES explained up to 64% of the variance of results in mathematics at the level of the students and approx. 9% of the variance at the school level (estimation of variance is shown in Table A3 in the appendix). In 2012, it was 40% and 8%, respectively. In the case of reading, we observe a reduction in the overall variance of performance and a reduction in the importance of SES in the explained variance (from 54% to 32% at the level of students), and a slight decrease of the explained variance at the level of schools (from 9% to 5%). These results suggest that SES is determining the performance of students in subsequent editions of PISA to a lesser extent.

Inequalities at the threshold of upper secondary school: the impact of parental education on the choice of school

In his article, Sawiński also verified the hypothesis on the impact of SES on choice of school. In this case, the matter is more complicated. In 2000, fifteen-year-olds were surveyed, whereas in the additional PISA components in the years 2006 to 2012, the population was defined as students of the first year of upper secondary school (also students from the second year in 2006). This means that the surveyed students had one additional year of education. It is known from other studies that increases in skills vary considerably in different types of schools (Dolata, Jakubowski and Pokropek, 2013; Rajchert, Żółtak and Smulczyk, 2014). The task is also hindered by the fact that in Polish national PISA options, the ESCS index was not scaled. For this reason, Sawiński used the educational attainment of parents, which is a variable related only to one of the dimensions of family socio-economic status and is a categorical variable.

As in the case of analyses on students from lower secondary schools, it is worth taking a closer look at the indicators of variation of student performance. I limited the comparison to fifteen-year-old students surveyed in the PISA 2000 edition and sixteen-year-olds in the years 2006, 2009 and 2012. Sawiński compared the correlations for each edition of PISA, not taking into account the fact that some of the analysed students were older. Among fifteen-year-olds, the percentage of students repeating a grade in the period of 2003–2012 was approx. 4–5%, while in the national PISA option, such students accounted for approx. 9–13% of the sample. This means that some of the surveyed students had not finish lower secondary school in the year provided by Sawiński, but earlier (Sawiński, 2017, Table A2). This disrupts the comparisons of PISA 2000 with subsequent editions of the study. A more appropriate approach would be to include grade repetition in the models or drop older students and compare only fifteen-year-olds (surveyed in 2000) and sixteen-year-olds (surveyed since 2006 and later). The second strategy has been used in this article.

The variation of performance decreased. This is mainly due to improved performance of the weakest students. The PISA study from 2006, 2009 and 2012 was carried out among students who were a year older and had approx. 7 months of additional instruction in upper secondary school, which probably exacerbated the differences in student performance. Table

[2] The corresponding models for mathematics provide a similar picture of changes: unlike reading, mathematics shows a linear relationship, and the estimated effects of ESCS are smaller.

3 also shows the differences between the average results achieved by students from different types of schools. The differences decreased, but this seems to be mainly the result of improved performance of students entering basic vocational school students. The differences between the average performance of students from vocational and general upper secondary schools remained at a similar level.

Has the impact of parental socio-economic status on the choice of school decreased? Sawiński answered this question by comparing the coefficients of canonical correlation between parental education and the type of school attended by the child. He reached the conclusion that in the PISA editions conducted after 2000, the relationship between school choice and parental education was slightly weaker. This is a far-reaching simplification. There are many factors that may have affected the observed correlations. First, between 2000 and 2012, we observed changes in the percentage of students selecting particular types of schools. The author mentioned this issue, referred to official statistics and found that there were no significant changes in the analysed period. However, the analysed PISA data show visible differences: in 2000 there were 42% (*se* = 1.5%) of fifteen-year-olds in general upper secondary schools, whereas in 2012 there were approx. 49% (*se* = 1.3%) of sixteen-year-olds in general upper secondary schools. However, the percentage of students attending basic vocational schools decreased (respectively 22%; *se* = 1.4% and 13%; *se* = 0.8). Second, between 2000 and 2012 we observed a change in educational choices, related both to parental education and sex. This is evidenced by the significance of interaction terms in the multinomial logistic regression model, in which the variable being explained was the type of school, and the explanatory variables included: the interaction of sex and the year of the study, and highest parental education (3 categories) and the year of the study. For the pooled data from PISA 2000 and the national options from the years 2006 to 2012, interaction is significant both for parental educational attainment ($F(14, 66) = = 49.09$; Prob > $F = 0.00$), and sex ($F(16; 64) = = 45.11$; Prob > $F = 0.00$). As sex is correlated with performance and the choice of school (regardless of the level of performance), this is a major confounding variable in explaining educational choices.

Another important problem omitted in the article by Sawiński is the role of students' performance. The possibility of including this

Table 3

Changes in the level and dispersion of reading skills and the value of the ESCS indicator in the years 2000–2012 for fifteen-year-old students surveyed in 2000 and sixteen-year-olds surveyed in 2006–2012

		Year of study (age)			
PISA result	Indicator	2000 (15)	2006 (16)	2009 (16)	2012 (16)
	M	479.1	530.4	510.5	525.8
	SD	99.8	105.0	90.5	87.8
(Reading)	P90–P10	260.1	273.4	236.0	228.0
	P50–P10	143.6	149.7	131.8	124.7
	P90–P50	116.5	123.7	104.2	103.3
Differences between general upper secondary school and:					
vocational upper secondary school		-65	-79	-74	-67
basic vocational school		-186	-193	-171	-159
% of variance explained by school type		0.50	0.35	0.43	0.38

information is the main advantage of PISA data. Children of better educated parents not only choose a more prestigious school, but also have better educational achievements. This distinction is crucial in understanding the process of selection. Sociological literature, based on Raymond Boudon (1974; also see: Jackson, 2013), distinguishes primary effects – effects that can be attributed to the differences in student skills – and secondary effects – associated with the choices made by the students. Secondary effects include, e.g. situations where choices made by students with a similar level of skills vary due to the socio-economic status of the family (see: Jackson, Erikson, Goldthorpe and Yaish, 2007). When it comes to choosing secondary school, educational inequality is evidenced not only by the total effect of SES, but also the direct (not mediated by student skills) effect of this indicator on the choice of school.

Analysing the effectsd of socio-economic status on the choice of school requires more complex methods that allow us to use categorical outcome and covariates. Traditionally, these analyses use logistic regression models, where the explained variable is the type of school, and the explanatory variables include the SES indicator and other control variables. However, the problem with such comparisons are the limitations of non-linear models and the complex interpretation of statistics illustrating the strength of the effects (Mare and Winship, 1984; Mood, 2010). A method to compare nonlinear effects between models was proposed by Kristian Karlson, Anders Holm and Richard Breen (2012). It allows to decompose the total effect of the variable into direct and indirect effects in non-linear models. In other words, it is possible to show the extent to which a particular variable (in this case – the level of skills) mediates the relationship between the explanatory variable (in this case – parental education) and the categorical variable that is being explained (unobserved variable in a nonlinear probabilistic model)

The hypothesis on the importance of the interaction between social position and students' skills in the choice of secondary school was verified by Henryk Domański and colleagues (2016) for the Polish data from PISA 2009. They showed that when choosing a secondary school, skills and social origin have an independent influence: skills do not moderate the impact of social background on the choice of school, but the inclusion of data on skills allows for a more accurate estimation of the effect of parental SES. In the following analyses, we will verify whether the relationship between parental education and choice of school includes a mediation effect, which would indicate the direct impact of parental education and indirect effects, in which parental education affects students' skills, hence increasing the chances of choosing a particular type of school. Such an analysis is important for the interpretation of educational inequalities, as it indicates the relative role of primary and secondary effects in the process of school selection.

The results of the analyses are shown in Table A4 in the appendix and are illustrated in Figure 2. Between 2000 and 2012, the impact of parental education on choice of school decreased, but the overall picture of this relationship is not clear. Having at least one parent with a university degree increases the probability of attending general upper secondary school and reduces the probability of attending vocational upper secondary or basic vocational school (only in the latter case was there a reduction of this effect between 2000 and 2012). As the percentage of parents with primary education only was low, information on parental education was recoded into three categories: basic vocational or lower; secondary or post-secondary; tertiary. Direct effects are relatively more important in the case of choosing general upper secondary school, whereas indirect effects are more important when choosing

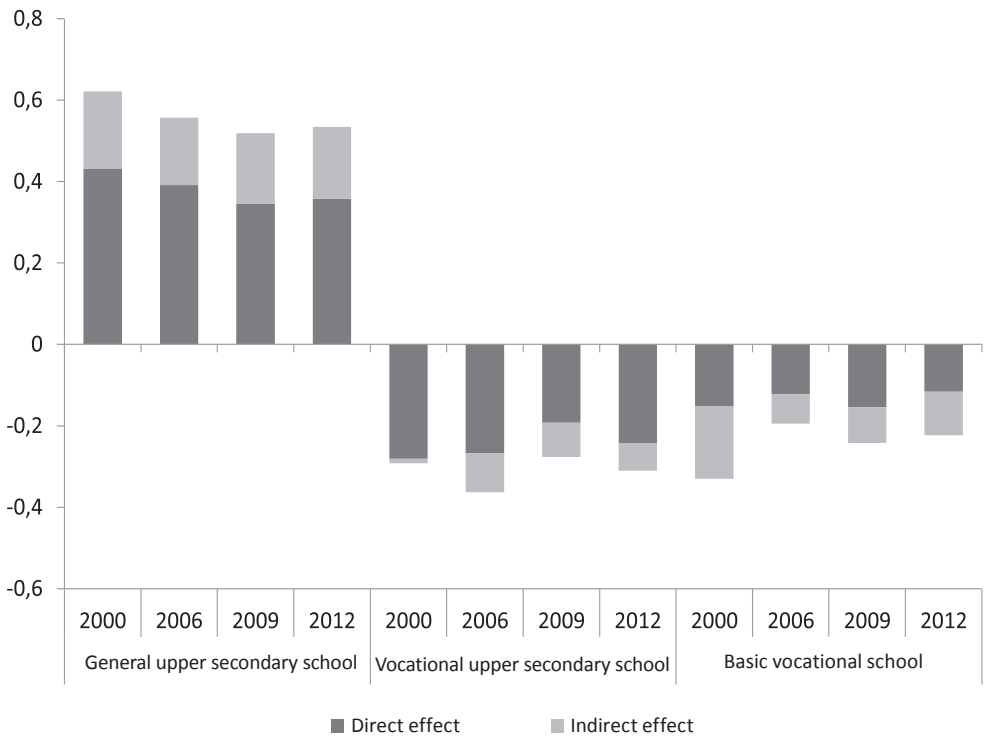

Figure 2. Estimates of the average marginal effects of parental educational attainment on the choice of school (tertiary education vs. basic vocational education) divided into indirect and direct effects in multinomial logistic regression models, decomposed by the Karlson–Holm–Breen method for the years: 2000, 2006, 2009 and 2012 (when controlling for sex).

basic vocational school. In other words, in the choice of basic vocational school, the skill level of a student of less educated parents is more important than the level of parental education by itself.

Conclusions

The interpretation of changes in educational inequality is not as simple and obvious as implied in the article by Zbigniew Sawiński. Similarly, the relationship between the reform of lower secondary schools and inequality is much more complex and difficult to explain in causal terms. The assessment of the impact of the reform of lower secondary schools on educational inequality remains an important and unsolved research problem. The challenge is to identify the mechanisms of that influence and to include different kinds of confounding factors that could strengthen or weaken inequalities in education. Most of the changes introduced at the turn of the twentieth and twenty-first century in the Polish educational system should encourage the reduction of inequality, but certain changes could have brought the opposite effect. Extending the length of general education should favour the reduction of inequalities in student performance. The introduction of external exams could have had the same effect, e.g. by drawing the attention of teachers and school principals to the achievements of the weakest

students[3]. But the availability of examination indicators could also have contributed to increased between-school variance in large cities, where students have the possibility of choosing the school to attend. Entrusting local governments with school management (and the associated change in funding rules) could promote differentiation in educational expenditure and increase educational inequalities (see: e.g. Herbst and Wojciuk, 2014). But it could also gradually promote the equalization of resources, e.g. by creating a more rational school network (from the point of view of educational expenses). These are just some examples of the complex factors relating to systemic solutions affecting educational inequalities. These factors probably had differing influences depending on local characteristics. Local school networks – as shown by Jan Herczyński and Aneta Sobotka (2017) – adapted to institutional and demographic changes in different ways. Widely understood social changes are another factor that is unrelated to educational policies. Many studies have shown the importance of family conditions for the physical, cognitive and socio-emotional development of children, which are interdependent and affect cognitive development. In the 1990s, income inequalities increased, other dimensions of the functioning of households also differentiated. Taking into account the variables characterising the SES of the student's parents makes it possible to include such factors in the analyses only to a certain extent, especially as they changed over time.

The PISA data is not a sufficient basis for assessing the effects of Polish educational reforms. The main problem is the lack of information on students' previous achievements. Other studies have shown that including students' performance at the start of school in the analysis significantly reduces the strength of the relationship between the SES of parents and the results achieved by the student (Dolata et al., 2013)[4]. This means that status factors have less impact on student performance during their study in lower secondary school, but still contribute to the differences in student progress. Without information on previous achievements, we cannot verify whether the changes in the strength of the relationship between SES and skills are the result of educational activities in lower secondary schools, or the result of earlier activities, e.g. in early childhood or primary school.

The conducted analyses have shown that in 2000–2012, the overall variation of student performance decreased, which was mainly the result of the improved performance of the weakest students. Although the strength of the relationship between socio-economic status and educational performance is similar in all editions of the study, the differences between students with high and low parental SES have decreased. Taking into account students' skills is of great importance when assessing the effects of SES in the selection of particular types of schools. Depending on the year of the study and the type of school, approx. 30–50% of the effect of parental education on the choice of school is mediated by students' skills. Unfortunately, the estimates on the strength of these effects are not very precise due to the relatively small effective sample size in the study of lower secondary school students in the additional, national option of

[3] In Poland, before the introduction of external examinations, students' performance could not be compared between schools. All students participating in the PISA 2003 study took a mandatory lower secondary school exam, and students from subsequent editions of the PISA study – also took a test after completing the 6th grade of primary school. With the introduction of the lower secondary school exam, the rules of recruitment to upper secondary schools changed. Students' admission to upper secondary schools is partly determined by the result of the lower secondary school exam (which completes the second stage of education, and is not an entrance exam) and partly by other achievements.

[4] In analyses of educational added value, taking into account students' performance at the start of lower secondary school decreases the strength of the effect 3–4 times, by approx. 1/3 of the standard deviation.

the PISA studies of 2006–2012. This issue is definitely worth studying further in future, taking into account other measures of socio--economic status than parental education.

Furthermore, as concerns the analyses of educational inequalities, not only the effect of socio-economic status on the achievements of fifteen-year-old students or unequal access to different types of secondary schools are important, but also taking a broader perspective on the problem. In the discussion presented in the literature on the effects of reforms, the crucial questions include short and long-term effects, for example, chances of starting and completing tertiary education, finding a job, the level of earnings, and achieved social position. By excluding these aspects, the discussion on educational inequalities becomes incomplete. A good example is the problem of choosing an upper secondary school. Analyses of the results of students participating in the PISA 2009 study (Domański et al., 2016) suggest that social inequalities relating to the decision to enter tertiary education are to a large extent based on previous educational decisions – e.g. social standing does not significantly affect the decision to study in higher education. Therefore, the analysis of educational inequalities requires a review of inequality at lower levels of education and vice versa: analysing the selection processes at lower levels of education is incomplete without taking into account further educational and professional paths and achieved social position.

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Appendix

Table A1
Estimates from the regression models explaining the results of the PISA study in reading in the pooled datasets from all PISA editions

	Model 1		Model 2		Model 3	
Variable	Effect	*se*	Effect	*se*	Effect	*se*
ESCS_st	36.05***	1.07	36.70***	3.06	37.10***	2.85
Squared ESCS_st	-2.280***	0.64	-2.28***	0.63	-1.67***	0.60
Girl					38.56***	6.16
Grade					69.58***	6.65
(PISA 2000)						
PISA 2003	16.21***	4.75	16.21***	4.74	20.77***	6.19
PISA 2006	27.46***	4.73	27.46***	4.72	31.43***	6.39
PISA 2009	20.56***	5.16	20.56***	5.17	20.84***	6.50
PISA 2012	38.11***	4.67	38.11***	4.68	40.04***	6.33
(PISA 2000*ESCS_st)						
PISA 2003*ESCS_st			1.84	3.36	-1.73	3.11
PISA 2006*ESCS_st			0.18	3.31	-3.16	3.17
PISA 2009*ESCS_st			-1.55	3.58	-5.52*	3.32
PISA 2012*ESCS_st			-3.74	3.40	-6.74**	3.18
(PISA 2000*girl)						
PISA 2003*girl					-2.05	6.75
PISA 2006*girl					0.03	6.70
PISA 2009*girl					6.85	6.69
PISA 2012*girl					0.96	6.33
(PISA 2000*grade)						
PISA 2003*grade					27.53**	10.82
PISA 2006*grade					29.95***	8.49
PISA 2009*grade					2.70	7.94
PISA 2012*grade						
Constant	482.7***	4.07	482.7***	4.05	463.1***	5.85
N	23.00		23.00		23.00	
R^2	0.15		0.15		0.25	

The ESCS variable was standardised into z-scores. In the girl variable boys are the reference category, and the grade variable: 1st grade of lower secondary school = -2; 2nd grade = -1; 3rd grade = 0; 1st grade of upper secondary school = = +1). Analytical and replication weights were rescaled so that their sum was the same in each edition of the survey.

Levels of significance: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A2
Changes of the effect of ESCS on reading performance in a mixed effect model with the random effects of schools (separate models for each year)

Variable explained: reading performance	Year of study							
	2003		2006		2009		2012	
	Effect	*se*	Effect	*se*	Effect	*se*	Effect	*se*
Fixed effects								
ESCS_st	34.89***	-0.75	38.14***	-1.06	36.78***	-0.63	25.80***	-1.08
Squared ESCS_st	-2.62**	-0.86	-2.997***	-0.60	-2.540***	-0.67	-3.465***	-0.68
Girl	38.32***	-1.86	38.78***	-0.93	48.20***	-1.43	41.69***	-1.01
Grade	100.50***	-5.15	105.2***	-2.92	86.08***	-3.63	75.67***	-2.50
Grade*ESCS_st	7.36	-3.92	15.47***	-3.38	19.64***	-4.90	10.38***	-2.10
Constant	479.10***	-1.84	488.7***	-0.96	476.7***	-0.64	499.0***	-1.04
Variance components								
Random part	648.50	18.43	934.0	26.32	538.2	20.09	1 282.7	31.16
Residual	6 251.70	58.06	6 903.5	58.32	5 142.0	28.54	5 058.2	31.61
N	4 362		5 417		4 884		4 547	

Levels of significance: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$.

Table A3
Changes of variance after taking into account the ESCS of the student in mixed-effects regression models with random effects of schools (separate models for each year)

Variables and estimates of variance	2003				2012			
	Empty model		Model with ESCS		Empty model		Model with ESCS	
	Effect	*se*	Effect	*se*	Effect	*se*	Effect	*se*
Models for reading								
Fixed effects								
ESCS_st			37.49	0.72			27.21	-1.06
Squared ESCS_st			-2.85	0.73			-3.81	0.66
Constant	490.70	0.82	494.10	0.96	512.60	0.56	516.70	0.94
Variance components								
Var(school)	1 744.70	20.34	801.40	12.03	2 094.80	38.12	1 425.10	37.49
Residual	7 907	59.77	7 219.70	55.55	6 160.10	46.71	5 824.50	42.92
N	4 362		4 362		4 547		4 547	
Models for mathematics								
Fixed effects								
ESCS_st			36.93	0.60			32.73	0.99
Squared ESCS_st			-1.82	0.89			-3.82	0.42
Constant	484.80	0.51	487.40	1.12	512	0.40	516.40	0.36
Variance components								
Var(school)	1 240	25.30	450.70	17.21	1 880.50	16.22	1 128.80	10.08
Residual	7 095.60	26.26	6 429.50	32.93	6 367.70	14.84	5 863.90	16.14
N	4 362		4 362		4 547		4 547	

Table A4

Estimates of the average marginal effects of the impact of parental education on choice of school (tertiary education vs. basic vocational education) divided into direct and indirect effect in multinomial logistics models decomposed with the use of Karlson–Holm–Breen method for 2000 and 2012 (controlling for sex)

		2000			2012		
Variables	Effect	GUSS	VUSS	BVS	GUSS	VUSS	BVS
Upper secondary vs basic vocational education	Overall	0.24	-0.02	-0.22	0.24	-0.10	-0.14
		(0.02)	(0.03)	(0.02)	(0.02)	(0.03)	(0.02)
	Direct	0.15	-0.06	-0.09	0.15	-0.09	-0.05
		(0.02)	(0.03)	(0.01)	(0.03)	(0.03)	(0.01)
	Indirect	0.09	0.04	-0.13	0.10	-0.01	-0.09
		(0.01)	(0.01)	(0.02)	(0.01)	(0.01)	(0.01)
Higher vs vocational education	Overall	0.62	-0.29	-0.33	0.53	-0.31	-0.22
		(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)
	Direct	0.43	-0.28	-0.15	0.36	-0.24	-0.12
		(0.03)	(0.03)	(0.02)	(0.04)	(0.03)	(0.02)
	Indirect	0.19	-0.01	-0.18	0.18	-0.07	-0.11
		(0.03)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)

Explained variable: reading performance; mediating variable: education; control variable: sex (decomposition APE – average partial (marginal) effects). Abbreviations: GUSS – general upper secondary school, VUSS – vocational upper secondary school, BVS – basic vocational school. Standard errors are given in parentheses.