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Equal opportunities and educational inclusion in Spain

Igualdad de oportunidades e inclusión educativa en España

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Abstract

There is a growing international consensus that considers equity as a necessary, though not sufficient, characteristic of the quality of education systems. PISA 2015 has established two fundamental pillars of equity: equal opportunities and educational inclusion. Regarding equal opportunities, the OECD has chosen to distinguish the influences on students from the circumstances, on the one hand, and the effort, on the other. Of the first the student would not be responsible; of the second if it would be, by virtue of their individual choices. Regarding educational inclusion, it has established a distinction between academic inclusion and social inclusion. The present work is based on that same conceptual framework, but it enriches the indicators of equality of opportunities through indexes of processes that would improve the results of the students operating on their circumstances from the school environment. From the samples of Spain and its seventeen autonomous communities in PISA 2015, this work makes the measurement of a broad set of indicators and analyzes the relationships between them. From this broad set of empirical results, it draws relevant consequences for the improvement of the education system in Spain and its autonomous communities in terms of equity.

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Resumen

Existe un consenso internacional creciente que considera la equidad como una característica necesaria, aunque no suficiente, de la calidad de los sistemas educativos. PISA 2015 ha establecido dos pilares fundamentales de la equidad: la igualdad de oportunidades y la inclusión educativa. En lo concerniente a la igualdad de oportunidades, la OCDE ha optado por distinguir las influencias sobre los alumnos procedentes de las circunstancias, por un lado, y del esfuerzo, por otro. De las primeras el estudiante no sería responsable; de la segunda sí lo sería, en virtud de sus elecciones individuales. En cuanto a la inclusión educativa ha establecido una distinción entre la inclusión académica y la inclusión social. El presente trabajo parte de ese mismo marco conceptual, pero enriquece los indicadores de igualdad de oportunidades recurriendo a índices de procesos que mejorarían los resultados de los alumnos operando sobre sus circunstancias desde el ámbito escolar. A partir de las muestras de España y de sus diecisiete comunidades autónomas en PISA 2015, se efectúa la medida de un conjunto amplio de indicadores y se analiza las relaciones entre ellos. De ese conjunto extenso de resultados empíricos se extraen consecuencias relevantes para la mejora del sistema educativo de España y de sus comunidades autónomas en materia de equidad.

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Over the last twenty to thirty years, a growing consensus has been generated, at European level, on the demand for equity of educational systems as a necessary condition of their quality (Hippe, Araújo & Dinis da Costa, 2016). In line with the positioning of the institutions of the European Union, the OECD has set its sights, in a progressive way (OECD 2005, 2018), on educational equity in the member countries.

In the edition of PISA 2015 equity in education is considered as a characteristic of

educational systems that involves “ensuring that education outcomes are the result of students’ abilities, will and effort, rather than their personal circumstances" (OECD, 2016a, p. 202). Nonetheless, the idea of equity in education “implies neither that everyone should achieve the same results, nor that every student should be exposed to identical, “one-size-fits-all” approaches to teaching and learning. Rather, it refers to creating the conditions for minimising any adverse impact of students’ socio-economic status or immigrant background on their performance”. (OECD, 2016a, p. 202).

Inspired by Rawls's theory of justice (1971), the central conceptual distinction in Roemer (1998) is, according to Kanburg and Wagstaff (2014), to “separate the influences on the outcome a person experiences into circumstances and effort: the former are attributes of a person’s environment for which he should not be held responsible, and effort is the choice variable for which he should be held responsible” (Kanburg & Wagstaff, 2014, p. 3). This conceptual framework has been explicitly assumed by PISA 2015 (OECD, 2016a).

However, and as Roemer himself has warned (Roemer & Trannoy, 2013), circumstances and effort are not easily separable variables, and the relationship between the two has remarkable empirical support in the field of school education. The family environment -especially parents- defines one of those circumstances that students do not choose and of which, therefore, they are not responsible for, but that, nevertheless, affects their disposition and academic results. The abundant evidence accumulated regarding the association between parental involvement and school performance (Consejo Escolar del Estado, 2014; Castro et al., 2014; 2015) suggests the existence of the aforementioned relationship.

Meanwhile, the values associated with effort and perseverance are predictors of academic performance (United States Department of Education, 2013). This suggests that some of the educational compensation actions would consist of operating on those school circumstances that, with a high probability, promote commitment to effort in the student's mind. The movement of Character Education (Lickona & Davidson, 2005; Character Education Partnership, 2008; Bernal, González & Naval, 2015), the current research on 'non-cognitive skills' (United States Department of Education, 2013; CERI-OECD, 2015; Méndez, 2014; Méndez, Zamarro, García & Hitt, 2015) and the position of employer organizations, at national (CEOE, 2017) and international levels (BIAC, 2016; Kairamo, 1989), have opted to incorporate the typical classical virtues of the sphere of the will (López Rupérez & García, 2017; Marina, 1997) to school education. By promoting such educational goals, one of the mechanisms through which the action of the family environment operates on students, in a sociocultural advantage situation (Forquin, 1990; Perrenoud, 1970; Roemer & Trannoy, 2013), would be simulated within the school. In a similar direction, the OECD has positioned itself by stating that “It is likely that confidence, effort and perseverance are more critical for students with less-educated parents, who often endure greater hardships to achieve the same outcomes as their peers from more advantaged backgrounds” (OECD, 2018, p. 160).

In addition to these mechanisms that promote equal opportunities, pedagogy -as Nozick (1974) put it- if it is effective, constitutes a compensatory factor that acts on the processes. However, the existence of aptitude-treatment interaction (López Rupérez, 1995) -in the sense that different methodologies can be more or less effective depending on the academic level of students (Mourshed, Krawitz & Dorn, 2017) or of their socioeconomic level (UNESCO, 2004)- warns us of the need to ensure adjustments in pedagogical action and to resort, as far as possible, to personalized learning situations or, according to the name used by PISA, to 'adaptive instruction'.

On the other hand, educational inclusion makes reference, following PISA 2015, to a quality, or set of qualities, of the educational systems that allow them to guarantee that all their students achieve the key competences. According to this approach, “education systems where a large proportion of 15-year-olds has not learned the basic skills needed to fully participate in society are not considered as sufficiently inclusive” (OECD 2016a, p. 203).

This study adopts the conceptual framework of PISA 2015 (Figure I.6.2, OECD, 2016a) regarding equity and its foundations. However,

from the previous arguments, it is advisable to broaden the operationalization of this framework, by adding some complementary indicators of processes that can be calculated from the PISA 2015 database at national and autonomous community level. Figure 1 shows the indicators of equal opportunities and educational inclusion that have been used in this study and that will be defined and justified explicitly later. These territorialized secondary analyses on educational equity in Spain complete those carried out in a previous study (López Rupérez, García & Expósito, 2018a).

Methods

Sample

The global sample used in this study was formed by 15-years-old Spanish students who were enrolled in the three types of school - public, private and government-dependent private schools- that participated in the 2015 PISA assessment (N=39,066). The corresponding strata of this sample are statistically representative of the respective school populations of the 17 autonomous communities (N = 32,330) and of the national set (N = 6,736). In the analyses referring to the total of Spain, the weighting established in the international evaluation was used to define the representative sample of the Spanish population, from the non-extended samples of each of their autonomous communities and according to their population weights (López Rupérez, García & Expósito, 2018b). The data used are structured in two levels, the first corresponds to the student level and the second to the school level. In this last level we have added the data related to the questionnaire addressed to the principals of the schools in which the participating students were enrolled (N = 1,177).

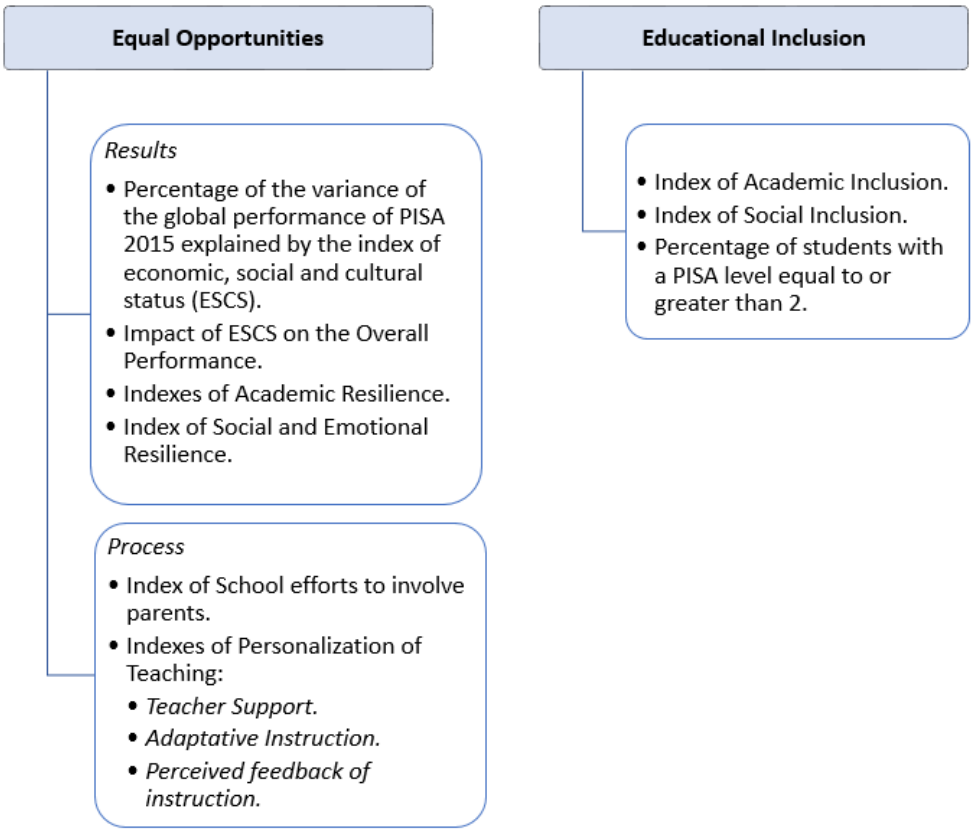


Figure 1. Indicators of equal opportunities and educational inclusion of this study

Measuring instruments

The measuring instruments used are those that have enabled PISA 2015 edition, to obtain the data whose secondary analyses are the subject of this study; that is, the Reading, Mathematics and Science tests (OECD, 2016b), and some context questionnaires (OECD, 2016c).

Indicators and variables

Equal opportunities

The selection of the set of indicators that are listed in Figure 1 adds to the four indicators of equal opportunity results established by PISA 2015 (OECD, 2016a), two process indicators whose empirical support has been described above:

a) Percentage of the variance of the global performance of PISA 2015 explained by the index of economic, social and cultural status (ESCS). It corresponds to the coefficient of determination R^2 of the relationship between performance and ESCS.

b) Impact of ESCS on overall performance. It is defined by the slope m of the regression line that best fits the corresponding distribution of points on a scattergram.

c) Indexes of Academic resilience. They refer to the extent to which the educational system of a country or region favours socially disadvantaged students being able to overcome their socio-economic and socio-cultural handicap and achieve good or very good academic performance (OECD, 2018). In this study the use of academic resilience indexes has been enriched by two specific circumstances of our study: the introduction of a territorial approximation by autonomous community, following a scheme analogous to that used by PISA for countries, and the reference in the calculations corresponding to the global score for each of the two resilience indexes IR_1 and IR_2 and not simply that of the Science area. In accordance with the above, the IR resilience index of an autonomous community is defined by two criteria:

IR_1 = Percentage of students in the lower quartile of the ESCS that are in the top quartile of global scores in PISA 2015.

IR_2 = Percentage of students in the lower quartile of the ESCS that have the competences of level 3 or higher in each of the three PISA areas.

While the IR_1 indicator provides a relative measure, or by comparison, of academic resilience, the IR_2 provides an absolute measure by referring to the acquisition, at least, of a basic level of competencies (OECD, 2018).

d) Index of Social and Emotional Resilience. According to PISA 2015 (OECD, 2018), it is considered that a socially disadvantaged student - that is, belonging to the lower quartile of the ISEC - is socially and emotionally resilient if he is satisfied with his life, he feels socially integrated in school, and does not suffer anxiety in exams. The corresponding index is defined as the percentage of socially disadvantaged students who meet these three conditions.

e) Indexes of Personalization of Teaching. From the PISA 2015 database, three standardized indexes (mean value = 0, standard deviation = 1) have been selected. These three indexes -of teacher support (ST077), adaptive instruction (ST107) and perceived feedback of instruction (ST104)- concern the degree of personalization of science teaching. This methodological approach has proven to be effective in previous research (López Rupérez et al., 1984); Dunkin, 1986; Fraser, Walberg, Welch & Hattie, 1987; López López, 2006; Pitzer & Skinner, 2016; Ricard & Pelletier, 2016).

f) Index of School efforts to involve parents. Its measurement is carried out through the SC063 questionnaire of school principals (OECD, 2016c, p.96). The corresponding indicator results from integrating the Yes / No responses to the four-item: 1. “Our school provides a welcoming and accepting atmosphere for parents to get involved”. 2. “Our school designs effective forms of school-to-home and home-to-school communications about school programmes and children’s progress”. 3. “Our school includes parents in school decisions”. 4. “Our school provides information and ideas for families about how to help students at home with homework and other curriculum-related

activities, decisions and planning". Regarding the third item, it should be noted that its value will depend on the proportion of private schools, in which the participation of parents in the School Board is not mandatory. With regard to the fourth, it should be emphasized that it is the most directly related to the concept of parental involvement, according to the literature (Consejo Escolar del Estado, 2014).

Educational Inclusion

g) Index of Academic Inclusion. From PISA (OECD 2016a), the Index of Academic Inclusion (IA) is calculated as:

$$IA = 100 \times (1 - \rho)$$

Where ρ represents the intraclass performance correlation, and is calculated as:

$$\rho = \frac{\sigma^2_{inter}}{\sigma^2_{inter} + \sigma^2_{intra}}$$

σ^2_{inter} being the variance in the performance of students between schools and σ^2_{intra} the variance in the performance within schools. IA is based on a multilevel approach; it varies between 0 and 100 and measures the probability that students with different abilities and academic needs share the same school.

h) Index of Social Inclusion. This index (IS), is defined in a homologous way to the previous one, only that referred to the ESCS of the students:

$$IS = 100 \times (1 - \rho)$$

And

$$\rho = \frac{\sigma^2_{inter}}{\sigma^2_{inter} + \sigma^2_{intra}}$$

Where σ^2_{inter}represents the variance in the ESCS of students between schools and σ^2_{intra} the variance within schools. This index measures the probability that students with different socioeconomic levels share the same school.

i) Percentage of students with a PISA level equal to or greater than 2. This indicator results from redefining the PISA 2015 indicator, which refers to the percentage of students with a PISA level equal to or less than 2. It is intended to convert it to a direct measure of the educational inclusion of the system.

Analysis procedures

In accordance with the conceptual framework and using the aforementioned measurement instruments, the following main procedures have been carried out:

1. Calculation of the indicators established in Figure 1, for Spain and for each of the autonomous communities
2. Analysis of the relations with the ESCS, expressed in quartiles, of the performance of the students, of the Indexes of Personalization of Teaching and of the Index of School efforts to involve parents.
3. Analysis of the relations between academic performance and equal opportunity indexes (academic resilience, personalization of the teaching and school effort to involve parents).
4. Analysis of relationships related to educational inclusion: academic and social inclusion *vs.* academic and socio-emotional resilience; academic inclusion *vs.* academic performance; and academic inclusion *vs.* social inclusion.

For this purpose, the two types of statistical analysis tools have been used: Simple linear regression analysis and Analysis of variance.

Results

In the field of equal opportunities

The *indexes of academic resilience* of type 1 (IR_1) and type 2 (IR_2) have been calculated from the direct measurements of the variables included in its definition. The corresponding results are presented in Table 1. According to indicator IR_1, based on quartiles of performance, Galicia (IR_1 = 19.2%) and Castile and León (IR_1 = 18.5%) are in the first positions, and Andalusia (IR_1 = 8.1%) and

Canarias (IR_1 = 8.4%) in the last. The national average stands at 11.3 percentage points. A similar circumstance is repeated for the IR_2 index, based on performance levels, with Galicia (IR2 = 43.6%) and Castile and León (IR_2 = 41.6%) located in the first positions and the Canary Islands (IR_2 = 19.9%) and the Region of Murcia (IR_2 = 25.0%) in the last. The total for Spain reaches 30.4 percentage points.

Table 1 shows the values of the *index of social and emotional resilience*, and its disaggregation into its three components. As far as this indicator is concerned, the total score for Spain is 18.7%, with the Baleares Islands (23.7%) and Catalonia (23.2%) obtaining the best results; and the Canary Islands (15.6%) and the Region of Murcia (17.4%) obtaining the worst. However, when the contributions by components are analysed, in the second component -the social integration of the student in the school- the previous arrangement changes markedly. We will return to this point in the Discussion.

Tabla 1 - *Values for Spain and by autonomous communities of the indicators of equal opportunities R^2 and m, associated to the linear regression analysis of the global performance in PISA 2015 vs. ESCS, as well as the academic resilience indexes and social and emotional resilience*

	Global performance in PISA 2015 *vs.* ESCS		Indexes of academic resilience (%)		Index of social and emotional resilience (%)
	Intensity, R^2 (%)	Impact, m	Relative, IR_1	Absolute, IR_2	
Spain	0,16	26,62	11,3	30,4	18,7
Andalucía	0,16	26,36	8,1	26,8	21,6
Aragón	0,14	26,56	13,1	37,6	22,9
Asturias	0,19	30,01	11,0	30,6	21,9
Baleares (Islas)	0,11	23,96	11,3	27,6	23,7
Canarias	0,15	27,05	8,4	19,9	15,6
Cantabria	0,11	23,88	10,8	31,5	19,6
Castilla y León	0,09	19,83	18,5	41,6	19,6
Castilla-La Mancha	0,14	23,59	12,7	34,8	17,7
Cataluña	0,16	27,52	11,4	31,7	23,2
Comunidad Valenciana	0,14	23,96	9,9	29,7	21,0
Extremadura	0,13	24,01	11,2	28,4	18,3
Galicia	0,07	18,69	19,2	43,6	19,9
Madrid (Com. de)	0,17	27,53	16,0	34,8	16,7
Murcia (Región de)	0,19	28,07	10,1	25,0	17,4
Navarra (Com. Foral de)	0,15	26,41	14,0	36,1	22,0
País Vasco	0,09	21,36	9,2	27,1	20,9
La Rioja	0,15	27,15	10,1	30,8	18,5

Note: The measures corresponding to the indicators *Percentage of the variance explained by the ESCS* (R^2) and *Impact of the ESCS* on the overall performance (m) come from our previous study (López Rupérez, García & Expósito, 2018a).

The *index of teacher support* is a first approximation to the degree of personalization of science education whose results are shown in Table 2. Spain presents a score of 0.07, positive and therefore above the OECD average (0.00); in this case Andalusia (0.18) and the Region of Murcia (0.15) are in the top positions and the Basque Country (-0,13) and Navarre (-0.09) at the bottom.

The measure of the *index of adaptive instruction* gives the results shown in Table 2. For Spain, an index value equal to 0.15 is observed. Again, the Region of Murcia (0.28) and Andalusia (0.23) occupy the first positions

in the corresponding table, while Catalonia (0.05) and the Basque Country (0.08) bring up the rear.

Regarding the *index of perceived feedback of instruction*, Table 2 shows the results of PISA measures. From its analysis, a positive value equal to 0.13 for Spain is inferred, with Andalusia (0.21) and Asturias (0.20) located in the first positions of the table and Galicia (-0.04) and Aragón (-0.03) located at the bottom and with negative values with respect to the OECD average.

Table 2 also shows the values of the *index of school efforts to involve parents*, as well as the values of their four components. As in the OECD countries and as a result of what PISA calls 'social desirability' (OECD, 2016c) -that is, the production of answers by the school principals that are considered socially preferred-, in Spain and in its autonomous communities the average values are close to 100% with differences that are often small. In any case, Spain´s total (90.9%) is above the OECD average (88.2%) (OECD, 2016c) Castile and León (94.4%) and Extremadura (93.9%) being the autonomous communities with the highest scores and Asturias (87.0%) and Cantabria (88.9%) having the lowest scores. With the intention of delving further into the origin of the differences, these global scores have been disaggregated into their four components.

Tabla 2 - *Values for Spain and by autonomous communities of the indexes of personalization of teaching and the Index of school efforts to involve parents*

	Indexes of personalization of teaching			Index of school efforts to involve parents (%)
	Index of teacher support	Index of adaptive instruction	Index of perceived feedback of instruction	
Spain	0,07	0,15	0,13	90,91
Andalucía	0,18	0,23	0,21	92,45
Aragón	-0,06	0,10	-0,03	89,58
Asturias	0,06	0,17	0,20	87,02
Baleares (Islas)	0,07	0,10	0,06	91,98
Canarias	0,07	0,14	0,15	92,45
Cantabria	0,05	0,15	0,11	88,89
Castilla y León	-0,04	0,12	-0,02	94,44
Castilla-La Mancha	0,04	0,13	0,10	91,82
Cataluña	0,08	0,05	0,09	92,31
Comunidad Valenciana	-0,03	0,09	0,12	95,19
Extremadura	0,14	0,19	0,16	93,87
Galicia	0,04	0,06	-0,04	90,68
Madrid (Com. de)	-0,03	0,09	0,04	90,20
Murcia (Región de)	0,15	0,28	0,16	91,98
Navarra (Com. Foral de)	-0,09	0,1	0,08	90,00
País Vasco	-0,13	0,08	0,05	92,94
La Rioja	-0,03	0,16	0,19	93,60

In the field of educational inclusion

With the intention of having more complete information than that offered by PISA 2015 for the participating countries, in this study the *indexes of academic inclusion* have been calculated for each of the three areas and not only for the Science area. Table 3 shows the resulting values by autonomous communities, together with the national total. The following facts are inferred from the analysis:

- The high values obtained by Spain in Science (86.6 %), above the OECD average (69.9%) (OECD, 2016a).

- An appreciable dispersion for each autonomous community between the values corresponding to the three areas for each autonomous community, in particular between that of Science and the rest.
- An outstanding position in the Basque Country (94.97%) and Navarre (94.83%) in Science and delayed in Andalusia (83.27%) and Aragón (85.70%)

Table 3 - *Values for Spain and by autonomous communities of the indexes of academic inclusion, social inclusion and percentage of students with a PISA level equal to or greater than 2*

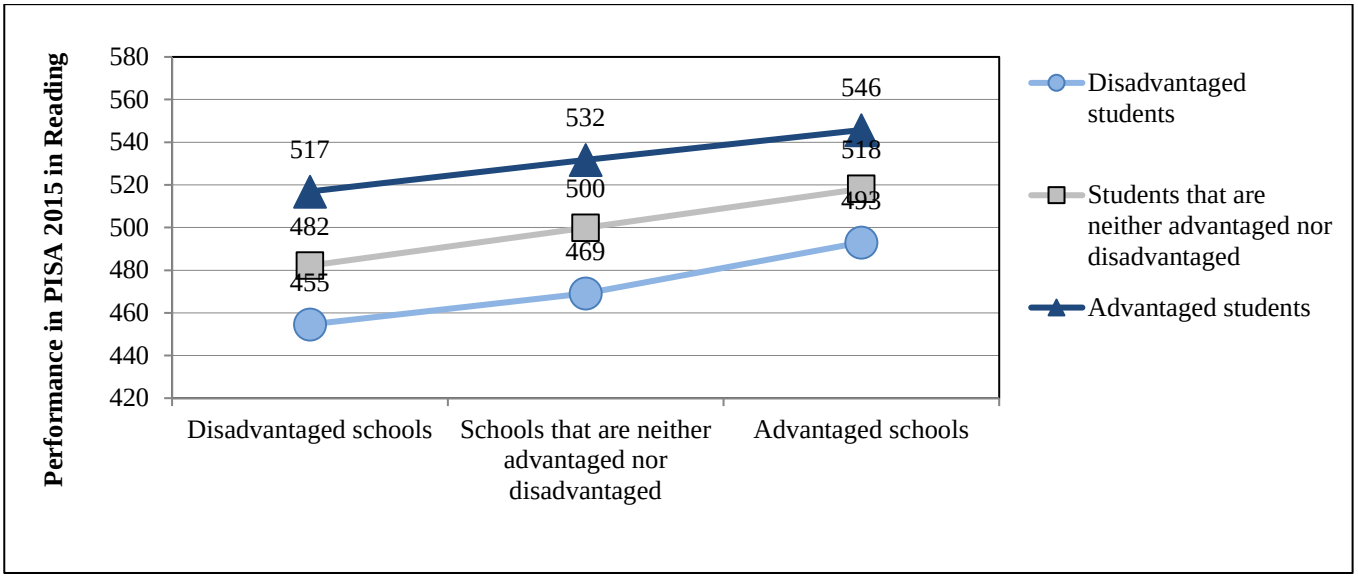
	Indexes of academic inclusion (%)			Index of social inclusion (%)	Students with a PISA level equal to or greater than 2 (%)		
	Reading	Mathematics	Science		Reading	Mathematics	Science
España	84,99	85,45	86,60	69,29	86,90	81,00	83,90
Andalucía	89,55	91,58	83,27	76,75	82,20	74,00	78,20
Aragón	92,59	93,48	85,70	82,02	88,80	85,70	88,00
Asturias	92,17	91,68	86,14	72,39	87,40	82,70	86,50
Baleares (Islas)	94,43	93,82	86,74	86,48	84,00	78,70	81,70
Canarias	82,66	84,46	89,67	69,38	82,30	67,40	78,70
Cantabria	90,16	90,89	89,80	80,02	88,00	83,40	85,30
Castilla y León	93,12	94,14	89,85	82,85	93,40	87,70	91,10
Castilla-La Mancha	87,90	88,06	90,12	73,15	87,90	81,80	85,50
Cataluña	87,77	86,86	91,06	69,98	87,40	84,80	85,80
Comunidad Valenciana	93,15	94,68	91,08	80,19	89,20	83,20	86,20
Extremadura	90,89	91,93	92,18	79,94	80,20	76,20	78,30
Galicia	92,26	93,45	93,20	81,40	88,90	84,50	88,30
Madrid (Com. de)	89,95	89,09	93,64	61,82	91,60	86,90	89,80
Murcia (Región de)	92,73	94,28	93,77	79,14	84,50	76,40	82,40
Navarra	88,18	90,90	94,83	77,45	90,80	90,20	89,00
País Vasco	85,29	85,25	94,97	70,30	85,50	82,50	81,90
La Rioja	91,39	91,66	93,34	81,29	83,60	84,70	83,00

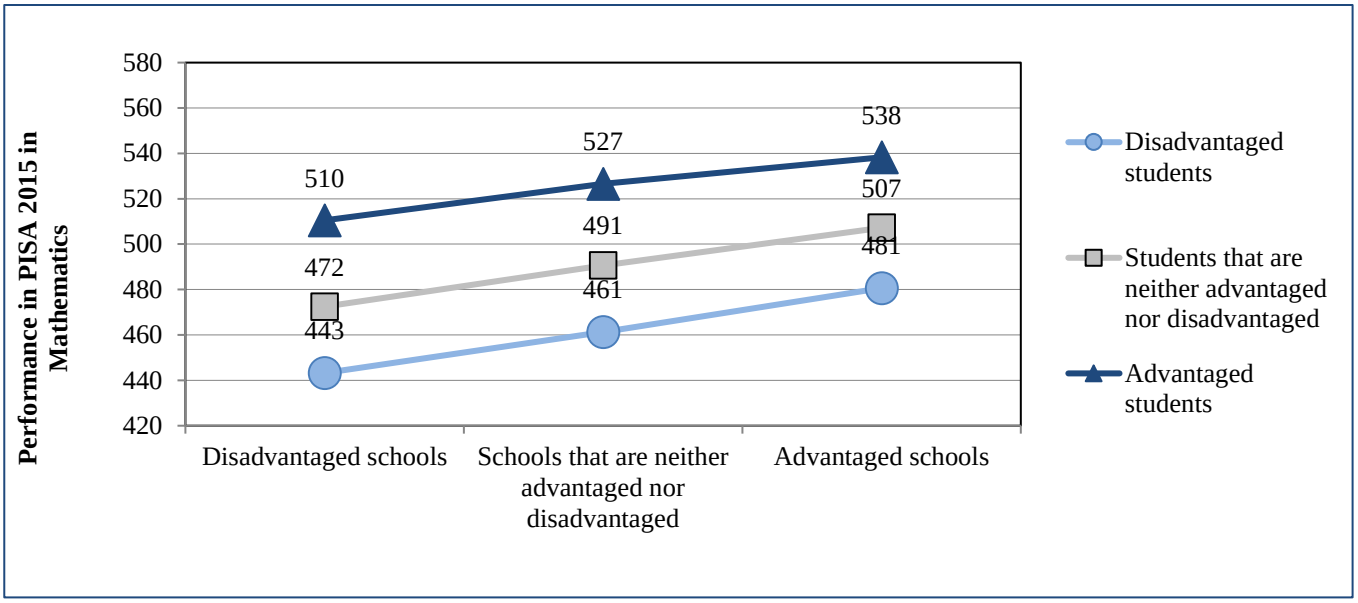
The *index of social inclusion* in school has been calculated for each of the autonomous communities and for the total of Spain. Table 3 shows the results obtained. Against the value of 69.29% obtained for Spain, in the first positions of the autonomous communities table are the Balearic Islands (86.48%) and Castile and León (82.81%), and Canarias (69.38%) and the Community of Madrid (61.82%) in the latter, but higher than the OECD average (61.0%) (OECD, 2016a). The probable influence of residential segregation of socioeconomic origin will be analysed in the Discussion.

The percentage of students with a PISA level equal to or greater than 2 is the most generic educational inclusion indicator among those adopted in this study. Table 3 shows the results obtained for the autonomous communities and for the national total in each of the three areas considered. They are high, in general, particularly for the area of reading. In the area of Science, Spain with 83.90% is above the OECD average (69.0%) (OECD, 2016a). In this case, the autonomous communities of Castile and Leon (91.10%) and the Community of Madrid (89.90%) are at the top of the table and Andalusia (78.20%) and Extremadura (78.30%) are at the bottom.

Some relevant associations

The diagrams in Figure 2 shows how the different PISA scores vary in Spain for three socioeconomic categories of student and school: the disadvantaged (quartile Q1 of ESCS) the advantages (quartile Q4) and the rest.





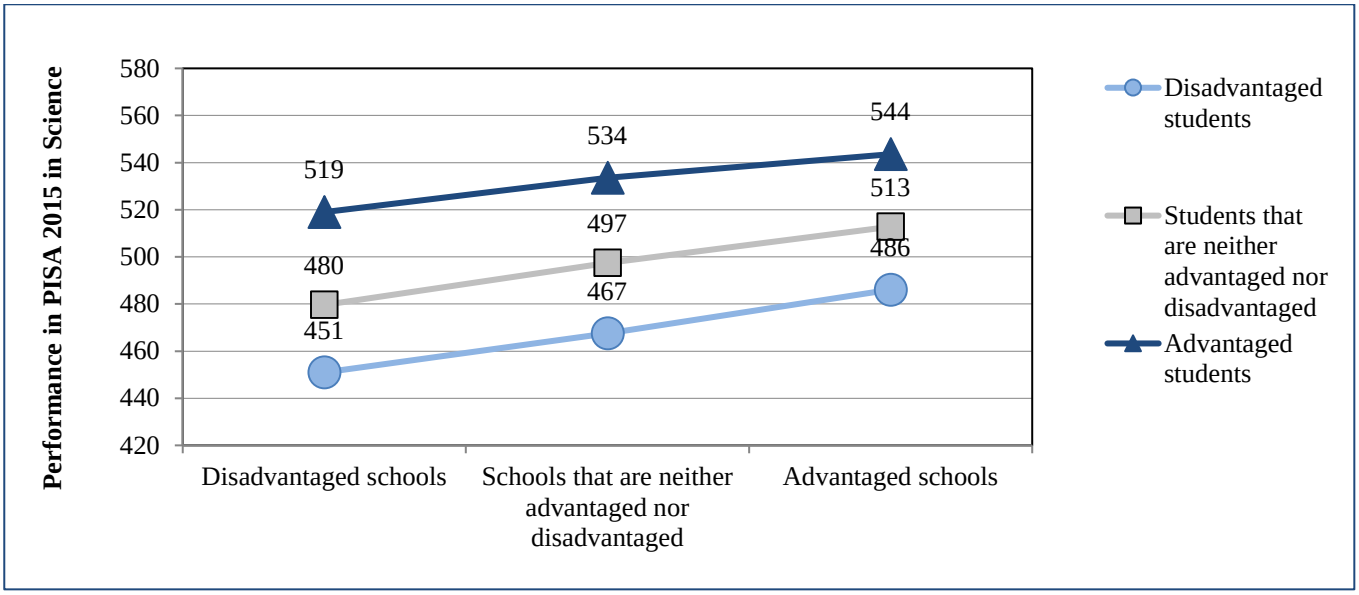


Figure 2. *Performance in PISA 2015 in Reading, Mathematics and Science and socioeconomic profile of the school and the student in Spain*

From the analysis of the graphics of Figure 2, it can be inferred that the pattern of association of performance with the degree of social disadvantage at the school and student level is similar in each of the three PISA areas.

On the other hand, from the PISA data on Spain relating to the characteristics of academically resilient students according to the IR_2 index (Science), it is possible to calculate the distribution of resilient students among socioeconomically advantaged and disadvantaged schools. The corresponding calculation shows figures of 62.1% for the first group of schools and 37.9% for the second. This provides interesting information that will be analysed in the Discussion.

Table 4 - *Values of the indexes of personalization of teaching and the Index of school efforts to involve parents by quartiles of ESCS of the students and the schools for Spain and by autonomous communities*

	Index of teacher support			
	Q1 (student ESCS)	Q2 (student ESCS)	Q3 (student ESCS)	Q4 (student ESCS)
Spain	0,19	0,06	0,09	-0,02
Andalucía	0,29	0,12	0,13	0,09
Aragón	0,11	-0,02	-0,11	-0,14
Asturias	0,2	0,09	0,03	-0,02
Baleares (Islas)	0,16	0,15	0,01	-0,06
Canarias	0,16	0,12	-0,01	-0,05
Cantabria	0,09	0,08	0,1	-0,05
Castilla y León	-0,04	-0,05	0,05	-0,13
Castilla-La Mancha	0,1	0,01	0,03	0
Cataluña	0,18	0,14	0,05	0,03
Comunidad Valenciana	0,09	0,04	-0,13	-0,09
Extremadura	0,26	0,07	0,19	-0,04
Galicia	0,11	0,1	0	-0,02
Madrid (Comunidad de)	0,12	0,04	-0,06	-0,1
Murcia (Región de)	0,32	0,16	0,08	-0,06
Navarra (Com. Foral de)	0,01	-0,08	-0,21	-0,04
País Vasco	-0,04	-0,16	-0,11	-0,17
La Rioja	0,1	0	-0,04	-0,12
	Index of adaptive instruction			
	Q1 (student ESCS)	Q2 (student ESCS)	Q3 (student ESCS)	Q4 (student ESCS)
Spain	0,2	0,12	0,19	0,1
Andalucía	0,25	0,19	0,23	0,24
Aragón	0,23	0,13	0,12	0
Asturias	0,27	0,21	0,13	0,12
Baleares (Islas)	0,22	0,06	0,07	0,06
Canarias	0,1	0,23	0,12	0,09
Cantabria	0,16	0,21	0,15	0,08
Castilla y León	0,17	0,08	0,13	0,12
Castilla-La Mancha	0,18	0,15	0,15	0,04
Cataluña	0,1	0,05	0,05	0,02
Comunidad Valenciana	0,12	0,06	0,05	0,13
Extremadura	0,26	0,21	0,2	0,06
Galicia	0,12	0,06	0,04	0,02
Madrid (Comunidad de)	0,16	0,11	0,13	0,04
Murcia (Región de)	0,39	0,33	0,19	0,17
Navarra (Com. Foral de)	0,17	0,09	0,07	0,11
País Vasco	0,08	0,05	0,11	0,08
La Rioja	0,17	0,2	0,21	0,07

Table 4 *(cont.)*

	Index of perceived feedback of instruction			
	Q1 (student ESCS)	Q2 (student ESCS)	Q3 (student ESCS)	Q4 (student ESCS)
Spain	0,26	0,11	0,11	0,05
Andalucía	0,33	0,19	0,17	0,05
Aragón	0,09	0,04	-0,08	-0,1
Asturias	0,37	0,26	0,16	0,07
Baleares (Islas)	0,16	0,08	0,04	-0,06
Canarias	0,24	0,24	0,11	-0,04
Cantabria	0,14	0,2	0,09	0,03
Castilla y León	0,07	-0,09	-0,03	-0,03
Castilla-La Mancha	0,17	0,07	0,1	0,04
Cataluña	0,24	0,18	0	0,03
Comunidad Valenciana	0,34	0,13	0	0,04
Extremadura	0,17	0,23	0,17	0,08
Galicia	0,02	-0,04	-0,02	-0,09
Madrid (Comunidad de)	0,11	0,2	0,01	-0,04
Murcia (Región de)	0,33	0,18	0,09	-0,06
Navarra (Com. Foral de)	0,21	0,09	0,1	-0,03
País Vasco	0,01	0,09	0,09	-0,01
La Rioja	0,21	0,22	0,23	0,11

	Index of school efforts to involve parents (%)			
	Q1 (school ESCS)	Q2 (school ESCS)	Q3 (school ESCS)	Q4 (school ESCS)
Spain	93,51	92,81	90,32	89,74
Andalucía	96,15	93,75	83,33	92,86
Aragón	87,5	89,58	93,75	83,93
Asturias	86,36	83,93	87,5	90,38
Baleares (Islas)	92,86	94,74	92,31	82,14
Canarias	93,75	95	87,5	87,5
Cantabria	89,29	91,67	80,56	97,73
Castilla y León	100	93,33	92,31	94,12
Castilla-La Mancha	94,32	93,18	88,89	88,46
Cataluña	94,44	95,31	88,64	90,63
Comunidad Valenciana	97,22	97,06	91,07	95,83
Extremadura	95	93,33	95	90,63
Galicia	97,73	90,79	86,84	90
Madrid (Comunidad de)	90,63	93,75	94,44	87,5
Murcia (Región de)	92,11	95,31	92,5	84,38
Navarra (Com, Foral de)	93,75	91,67	88,24	88,46
País Vasco	88,46	95,45	96,88	89,66
La Rioja	100	89,29	95,83	89,29

Regarding the associations with academic performance, the relationship between the *academic resilience indexes* IR_1 and IR_2 and the PISA 2015 results will enable us to know to what extent these Equal opportunity indicators predict academic performance. Table 5 shows the values of the R^2 resulting from the corresponding linear regression analyses, together with those of their statistical significance, carried out for the whole of the

autonomous communities and the total of Spain. The global values of PISA 2015 corrected for the effect of the ESCS have been considered for performance measurement.

Tabla 5 - *R^2 and statistical significance values corresponding to the relationships between academic resilience indexes and overall performance in PISA 2015, corrected for the ESCS effect*

	IR_1	IR_2	Overall performance
IR_1		R^2 = 0,81 (0,00)	R^2 = 0,59 (0,00)
IR_2	R^2 = 0,81 (0,00)		R^2 = 0,73 (0,00)
Overall performance	R^2 = 0,59 (0,00)	R^2 = 0,73 (0,00)	

Note: The values in parentheses correspond to the statistical significance of R^2.

These results reveal that the predictive value of academic resilience with respect to PISA 2015 scores is high, particularly for IR_2; and that the strength of the relationship between both indexes is considerable, which shows its coherence.

In the case of the association between the *indexes of personalization of teaching* and performance, there is also sufficient empirical evidence showing that the personalized science teaching approach is a significant factor for explaining the results of the students (López López, 2006, Hattie, 2017). Both for the index of teacher support (R^2 = 0.10, sig = 0.21), and for the index of adaptive instruction (R^2 = 0.10, sig = 0.21) the relationship is weak and statistically not significant. In the case of the index of perceived feedback of instruction, the relationship is relatively weak (R^2 = 0.26) but statistically significant at a probability level slightly higher than 95% (sig = 0.03). However, the inverse observed relationship -higher feedback, lower performance – is counterintuitive and contrary to the evidence accumulated through meta-analytic syntheses (Hattie, 2009) that situate this element of teaching between those with the greatest impact on the students'results. This finding will be reconsidered in the Discussion.

School efforts to involve parents alludes to a type of policies at school level that, in accordance with the available empirical evidence (Castro et al., 2015), should have some impact on student performance. However, its relationship with the PISA score is extremely weak in our study (R^2 = 0.07) and statistically non-significant (sig = 0.27).

A third group of relevant associations is the one that refers to the *index of academic inclusion* and the *index of social inclusion*. Table 6 shows the values resulting from the different linear regression analyses with the resilience indexes -and their corresponding ANOVAS- for Spain and the autonomous communities. The analyses have been carried out separately for the social and academic dimensions. Their results show systematically weak and statistically insignificant R^2 values. This indicates an absence of connection between these indicators of equal opportunities and of academic and social inclusion.

Tabla 6 -*R^2 values and statistical significance for the relationships between the indexes of educational inclusion (academic and social) and the indexes of resilience (academic and social-emotional) for Spain and the autonomous communities*

	Academic inclusion			Social inclusion
	Reading	Mathematics	Sciences	
Academic resilience	R^2 = 0,06 (0,33)	R^2 = 0,09 (0,21)	R^2 = 0,00 (0,89)	
Social and emotional resilience				R^2 = 0,15 (0,12)

Note: The values in parentheses correspond to the statistical significance of R^2

With respect to the association between academic inclusion and student performance, and according to the results summarized in Table 7, there is an absence of statistical relationship between these two variables, in contrast to what was obtained for the academic resilience indexes (see Table 5). This could suggest the existence of a different type of behaviour for academic inclusion as a reliable predictor of school performance. This circumstance will be addressed in the Discussion.

Tabla 7 - *R^2 values and statistical significance for the relationships between the indexes of academic inclusion and the PISA 2015 scores, corrected for the ESCS effect, for Spain and the autonomous communities.*

		Academic inclusion		
		Reading	Mathematics	Sciences
Performance	Reading	R^2 = 0,19 (0,06)		
	Mathematics		R^2 = 0,06 (0,34)	
	Sciences			R^2 = 0,01 (0,71)

Note: The values in parentheses correspond to the statistical significance of R^2.

Finally, regression analyses between academic inclusion and social inclusion shows that these variables are not related to each other. Its coefficient of determination $R^2 = 0.02$ is extremely weak and the relationship between both is statistically insignificant (sig = 0.60). In the Discussion section we will expand the reasoning in this regard.

Discussion

In the field of equal opportunities

In accordance with the results set out above, it is necessary to address first the resilience indicators. The relatively strong relationship between the indicators of academic resilience and the overall performance in PISA 2015 (59% for IR_1 and 73% for IR_2 – suggest a possible mechanism to improve school performance, consisting of increasing the percentage of academically resilient students, promoting this type of non-cognitive skills and incorporating them explicitly into the school curriculum; all the more so since the plausibility of this direction of influence is considerably greater than the opposite.

The case of the *social and emotional resilience index* deserves special consideration. A regression analysis with the overall performance has shown no relationship to exist between the two indicators (R2 = 0.03; sig = 0.51). This could be a direct consequence of the absence of a causal connection between them, but it could also be related to the defective nature of this equal opportunity indicator. Thus, when the structure of this index is analysed in greater depth and the behaviour of its three components is measured against each of the quartiles Q of the ESCS, reasonable doubts arise about the validity of some of these components for the Spanish case. Thus, for example, experiencing anxiety in exams seems to be a cross-sectional phenomenon that is not clearly associated empirically with the ESCS quartile. However, satisfaction with life seems to be related with students' socioeconomic status, as well as, although to a lesser extent, social integration in school. This latter circumstance is probably linked to the culture of the school and its educational policies. However, the degree of anxiety in exams seems more dependent on the psychology of students and the inherited traits of their temperament or personality (Fox et al., 2015). Something similar can be said about the "satisfaction with life" component, which will

probably be influenced by a broader family and social context than the school itself.

Meanwhile, analysis of figure 2 reveals that whatever the type of student considered -advantaged, disadvantaged or intermediate- all seem to benefit from the effect associated with a higher level of social advantage of the schools in which they are enrolled. It is also interesting to highlight that the impact on student performance of social disadvantage due to schooling in socially advantaged schools is similar in any of the three areas considered: Reading (38 PISA points), Mathematics (38 PISA points) and Science (35 PISA points). This is compatible with a more general association -probably of a psychosocial nature- than those that would correspond to the different cognitive abilities of students for the corresponding subjects. With some territorial differences, in essence, the pattern of association observed for the variables considered above is the same in the different autonomous communities.

In relation to process indicators, attention may be focused, first, on the three *indexes of personalization of teaching* considered in our study. Regarding the analysis by quartiles of the ESCS, from Table 4 we infer a reasonable behaviour for the teacher support index, in the total of Spain, since for Q_1 the value of this index (0,19) is the maximum of the distribution and is also positive, with a positive difference (0,35) with respect to the fourth quartile. This indicates a differentiated educational treatment in favour of socially disadvantaged students. The analysis by autonomous communities does not reveal any anomalous behaviour, but it is nevertheless important to highlight the cases of the Basque Country and Castile and León which present negative values for Q1 and are therefore below the global average of this index for OECD countries.

Regarding the *index of adaptive instruction*, the figures of the total of Spain again indicate a value of this index for the first quartile equal to 0.20, with a difference between the first quartile and the fourth of 0,10. This behaviour, although reasonable in the sense that the teaching of Science is slightly more adaptive in socially disadvantaged students, presents a particularly broad improvement path in the Basque Country, Catalonia and the Canary Islands.

For the *index of perceived feedback of instruction*, the results obtained on the first quartile are 0.26 for the national total, with an appreciable difference between Q_1 and Q_4 of 0.21. Asturias (0.37) and Comunidad Valenciana (0.34) are in top positions, in relation to the value of this index for Q_1 students, while the Basque Country and Galicia are at the bottom in the national comparison (see Table 4).

According to the evidence generated in this study at national level, the impact of the personalization of teaching on student performance is not significant enough (Teacher support: R^2 = 0.10, sig = 0.21; Adaptive instruction: R^2 = 0.10, sig = 0.21; Perceived feedback of the instruction R^2 = 0.26, sig = 0.03). This could be due to an insufficient application of this type of teaching practice, particularly in students of lower socioeconomic level, as our data seems to indicate (see Table 5). For this reason, its relationship with performance would be weak, as observed. For example, only 26% of socially disadvantaged Spanish students (Q1) receive feedback from instruction according to their own perception; and only 11% of those located in the second quartile of the ESCS. However, it should be noted that this third component is the one with the highest frequency as a teaching practice, whose inverse correlation with performance, although moderate and barely significant, is the strongest of the three. This is compatible with our explanatory hypothesis. Thus, it is likely that feedback on instruction is being offered to students only when things are not going well, which would explain its inverse relationship with performance.

Our analysis of the relationship between the three procedures of personalization of the teaching of Science -support of the teacher, adaptation of instruction and perceived feedback on the instruction- and the corresponding scores in PISA 2015 have not provided conclusive results for the Spanish sample. Nevertheless, there is sufficiently robust evidence on the effectiveness of methodologies based on greater personalization of science education (López Rupérez et al., 1984, López López, 2006). This is particularly true in the case of the instruction feedback which, with an effect size of d = 0.90, has been revealed in the meta-analytical synthesis by John Hattie (Hattie et al., 2009) as the teaching factor that has the greatest influence on student performance in general.

On the other hand, studies carried out with observational methodologies, aligned with the research on effective schools (Downer, 1991), have shown the existence of aptitude-treatment interaction (Baillon,1992; Grisay,1982), in the sense that students at a low socioeconomic level who obtain good results benefit from more personalized and more structured teaching. Similar results have emerged from studies based on case analysis (Harris, 2003) and large-scale research (Mourshed et al.,2017). In this respect, and with the limitations that derive from the subjective nature of some of the indicators, a certain consistency is observed both in the results of the different indexes and in the pattern that results from the comparison for Spain as a whole. Thus, the degree of personalization of teaching measured by each of the three indexes considered is similar in the case of socially disadvantaged students (Q1). The difference of the values of these indexes for Q1 and Q4 is positive in all three cases, which indicates that the degree of personalization increases when the social advantage of students decreases.

Notwithstanding the above, an analysis by autonomous communities of the index of perceived feedback on instruction shows that the difference in the values for Q_1 and Q_4 is below that corresponding to the total of Spain for Aragón, Cantabria, Castile and León, Castilla-La Mancha, Galicia, La Rioja, the Community of Madrid and the Basque Country, and in some cases is smaller (see Table 5). One such circumstance seems to suggest that this aptitude-treatment interaction should be taken more into account in these autonomous communities, through more personalized teaching of sciences for socially disadvantaged students, with the strengthening of feedback procedures for instruction by the teacher. To this end, the corresponding educational administrations should provide special support to socially disadvantaged schools by reducing the student/teacher ratios and promoting specific training of their teachers based on available empirical evidence and on the definition of effective protocols of action.

With regard to the second group of process indicators, it is interesting to analyse whether policies that promote parental involvement are more accentuated in the schools that need it most. This could make one of the mechanisms that operate on the effort of students effective by changing their personal circumstances. Table 5 presents the values of the *index of school effort to involve parents*, according to the ESCS of the school, by autonomous communities. The behaviour of Spain as a whole indicates that the effort of the school is greater the smaller the order of the quartile. However, it is appreciated that in some autonomous communities this desirable behaviour, as an element of equalization is not present. Such is the case of Asturias, Cantabria and the Basque Country. At the other end of the spectrum is Castile and León and La Rioja, where the index reaches a value of 100.00% for the students of Q1.

Regarding the association of this processes index with the overall performance in PISA 2015, a linear regression analysis indicates that there is no statistically significant relationship

between them. We are, again, faced with a result of our data that is contrary to the abundant accumulated international empirical evidence (Castro et al, 2015). This discrepancy could be related to the low variability of the indicator as a result of the "social desirability" effect described above; but it could also reflect that it is precisely those students with difficulties who need more involvement of parents, even if this does not result in an appreciable improvement in performance, due precisely to its basic difficulties. In addition, this result would also be compatible with the fact that in the Spanish school system, the School Board -to which the third component of the index implicitly refers - is not mandatory for private schools and these are distributed very unequally among the autonomous communities, which generates problems of comparability. Moreover, the fourth item of this index ("our school provides information and ideas to families on how to help their children at home with homework and other activities, decisions and planning related to the curriculum") alludes to an induction mechanism of family practices in socioculturally disadvantaged environments that are frequent in more advantaged media. This points to the need to promote this type of practice, especially in disadvantaged schools and in those autonomous communities that do not display sufficient differences between their lower and upper quartiles of the ESCS (see Table 5), in particular Asturias, Cantabria and the Basque Country where such differences are negative. Specific permanent training of its faculty and its management teams based on empirical evidence and which contains the definition of effective action protocols constitutes the main recommendation for equalizing the effort of the students as a relevant factor.

In the field of educational inclusion

The second pillar of the expanded model of equity of this study is educational inclusion, measured by the indexes of academic inclusion and social inclusion and the percentage of students with a PISA level of 2 or higher, a level that is above 406 points PISA.

The calculation of the *academic inclusion index* for Spain as a whole shows a high value (86.6% for Science by comparison with 69.9% for the OECD average). That is, for Spain only the 13.6 percent of the total variance (see Table 3) in terms of PISA scores is attributable to differences between schools. Something similar can be said of the indicator "percentage of students with a PISA performance level equal to or greater than 2", for which Spain achieves values above 80 percentage points in the three areas of PISA (83.90% in Science compared to 69.0 points for the OECD average).

Regarding the *index of social inclusion*, and with the intention of refining the diagnoses, it is interesting to explore further the analyses of the low values of social inclusion of some autonomous communities. For example, the Community of Madrid with a figure of 62% is at the bottom of the table of autonomous communities in relation to this index, although above the OECD average (61.0%).

Using indicators such as the Gorard index (1998) or the Isolation Index (Lieberson, 1981), recent studies have highlighted the situation of the Community of Madrid, regarding school segregation by socioeconomic level (Murillo & Martínez-Garrido, 2018). Our figure for social inclusion shows a similar situation. While the aforementioned authors proceed to speculate about the link between this phenomenon and the free-choice policies of the Community of Madrid, the truth is that, as the literature warns (Brun and Rhein,1994) and the authors themselves acknowledge, «(...) School segregation is the product of many factors, one of them is residential segregation (...)» (p.54). It is particularly in urban environments where the majority of the school population of immigrant origin is concentrated and where the phenomenon of geographical segregation

occurs, which is based on segregation of a socioeconomic nature. In addition to the trend of immigration of economic origin to be grouped in the same neighbourhoods of large cities, a well-established social phenomenon is operating here, which is the clear preference of families to choose schools near their homes for their children, particularly in compulsory education (López Rupérez,1995, OECD, 1994). In the Community of Madrid, according to data from the INE (2018), 49% of its inhabitants reside in the capital and 71% do so in municipalities of more than 100,000 inhabitants (thirty points above the national average). For this reason, it is highly probable that the different socio-demographic characteristics of the Community of Madrid are mainly responsible for a residential segregation that would explain, to a large extent, the lower value of the social inclusion index, more than the support of the free choice of school by families.

In this circumstance, it is interesting to mention the absence of an observed relationship between the academic inclusion index and performance in any of the three PISA areas considered (Table 8). This would indicate a low predictive value of academic inclusion with regard to students' school performance. There are many variables that significantly affect the performance of students (Hattie, 2009), but the inclusion variable does not seem to have a significant impact in Spain. An insufficient range of variation of this index between the autonomous communities, due to the high values that Spain presents in this respect, or to the existence of interactions between variables not controlled in the present investigation, could be contributing to this lack of observed association.

On the other hand, the relationship between the two indexes of inclusion, academic and social, is not statistically significant. Therefore, and as in the Community of Madrid, it is possible that high values of academic inclusion coexist with relatively low values of social inclusion in the school. Even when from the civic and educational point of view the coexistence in the same school of different social groups is desirable, academic inclusion would have priority because of its probable link with equal opportunities in education.

The question of how to approach this desirable goal of greater school integration of different social groups arises at this point. The answer should not be sought by displacing socially disadvantaged students to advantaged schools and socially advantaged students to disadvantaged schools against the will of families. This would contravene the fundamental rights recognized in article 27 of the Spanish Constitution and in article 26.3 of the Universal Declaration of Human Rights. It is more a matter of operating on the side of incentives for greater integration and of the impulses for school improvement (López Rupérez, 1995). As suggested by the OECD in its most recent analysis of school choice (OECD, 2017), school vouchers - or equivalent scholarships - can be granted selectively to low-income families with the specific purpose of facilitating their mobility to socially advantaged private schools; or to ensure specific founding designed to facilitate transportation in the event that their choice is from a public school or one sustained by public funds. Other possibilities consist, for example, in providing economic incentives to socially advantaged schools to admit socially disadvantaged students, as has been applied in the Netherlands (OECD, 2018). Still another, closer to our context is to endow schools at a social disadvantage with very attractive programs. Such has been the case of the bilingual teaching program applied in schools that have signed up for the "Plan de Centros Públicos Prioritarios" of the Community of Madrid (López Rupérez, 2008). In addition, these initiatives, which aim to operate from the social inclusion plane, can and should be complemented with comprehensive policies of educational compensation that act on equal opportunities. The experience generated in this

respect by the aforementioned Plan and the results obtained in the evaluation of its impact (Inspección de Educación, 2008) endorse such a recommendation. In addition, and as has been pointed out above, it is likely that this type of intervention, if successful, will lead to an increase in social inclusion.

The relationship

The linear regression analysis comparing the academic resilience index and the academic inclusion index for each of the three PISA areas reveals, consistently, the absence of a statistically significant relationship between them. However, calculations made from the PISA data on the traits of academically resilient students indicate that resilience also occurs in an appreciable proportion in socially disadvantaged schools; or, in other words, that, with respect to academic resilience based on levels of performance, the social disadvantage of the school is not totally determinant for socially disadvantaged students. This conclusion is compatible with the weakness of the relationship between resilience and inclusion observed in the aforementioned regression analysis (Table 7) and points to two possible intervening factors.

First, the effort factor, which would be expressed in this case through academic resilience, could be operating in an individual way, that is, regardless of a balanced distribution of the students, or through the action of families -circumstances- , given that school success correlates better with certain aspects of the family environment-affective support, understanding, stimuli, etc. – than with the variables linked to social status, as different empirical studies have shown (Ainsworth & Batten, 1974, Fraser, 1959, Miller, 1971, Plowden, 1967). The second factor could be the compensatory action itself of socially disadvantaged schools that, without acting obviously on social inclusion, would be acting in favour of equal opportunities.

A similar analysis, albeit referring in this case to the relationship between the index of social inclusion and the index of students'social and emotional resilience (Table 7), reinforces again the thesis of the weakness of the association between these two groups of indicators. In summary, despite the systematic nature of the search, neither performance in PISA nor academic resilience, nor social and emotional resilience are clearly correlated with educational inclusion. This empirical evidence generated for the Spanish case shows that, according to our equity model, its two basic pillars - equality of opportunities and educational inclusion (academic and social)- can be considered complementary from the point of view of their educational desirability but also, very probably, in the sense of their statistical separation or absence of association.

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