Contextual and non-cognitive variables and peer effect as factors associated with grade repetition in Spain

Variables contextuales, no cognitivas y el efecto pares como factores asociados a la repetición de curso en España

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Abstract

Although it has slightly decreased in recent years, Spain remains one of the countries with the highest repetition rates. This study aimed to analyze the relationship between grade retention and both contextual and non-cognitive student factors in the Spanish PISA 2022 sample, with particular attention to the peer effect exerted by classmates on repetition. Using a sample of over 30,000 students and almost 1,000 schools, predictive variables were included both individually and aggregated at the school level to examine peer effects. Following a

selection of variables associated with grade repetition based on their correlations, multilevel logistic regression models with fixed slopes and random intercepts were applied. The results contribute to previous studies by highlighting a significant impact of the student's school environment on grade repetition. 15% of the variability associated with grade repetition can be explained by the grouping of students in schools. At the individual level, the contextual variables most strongly associated with repetition are family socioeconomic status and migration background. Among non-cognitive variables at the student level, the results indicate the significant protective effect of academic expectations, punctuality, perseverance, regular school attendance, and family support, as well as the risks associated with bullying, having numerous household responsibilities, or excessive use of ICT for leisure during the week. Additionally, the association between variables aggregated at the school level and individual repetition stands out. A higher percentage of female students in the school, high overall academic expectations, good overall levels of assertiveness among students, and appropriate use of ICT were found to exert a protective peer effect against grade repetition. Moreover, widespread poor eating habits or excessive domestic responsibilities emerge as risk factors displaying peer effects. The impact of these peer effects on grade retention raises questions about the strategies implemented within the educational system to promote academic success.

Key words: Grade retention, non-cognitive factors, contextual factors, multilevel logistic regression, compulsory secondary education.

Resumen

Aunque ha disminuido ligeramente en los últimos años, España sigue siendo uno de los países con una mayor tasa de repetición. El objetivo de este estudio fue analizar la relación entre la repetición de curso y tanto factores contextuales como no cognitivos del estudiante en la muestra española de PISA 2022, incluyendo el análisis del efecto pares que ejercen los compañeros sobre la repetición. Con una muestra superior a 30000 estudiantes y casi 1000 escuelas, se incluyeron variables predictoras tanto individualmente como agregadas al nivel escuela para estudiar el efecto pares. Tras una selección de variables asociadas a la repetición a partir de sus correlaciones, se aplicaron modelos logísticos multinivel de pendientes fijas e interceptos aleatorios. Los resultados aportan a los estudios previos que existe un impacto significativo del entorno escolar del estudiante sobre la repetición de curso. El 15% de la variabilidad asociada a la repetición de curso puede explicarse por la agrupación de los estudiantes en escuelas. A nivel individual, las variables contextuales de mayor asociación con la repetición son el nivel socioeconómico familiar y el estatus migratorio. Como variables no cognitivas, los resultados indican el importante efecto protector de las expectativas académicas junto con la puntualidad, la perseverancia, acudir siempre a clase o el apoyo familiar, así como el riesgo asociado a recibir *bullying*, tener muchas obligaciones domésticas o un uso excesivo de las TIC para el ocio durante la semana. Por otro lado, destaca la asociación de variables agregadas al nivel escuela con la repetición individual. Un mayor porcentaje de estudiantes de género femenino en la escuela, niveles generales elevados de expectativas académicas, buenos niveles de asertividad en los estudiantes, y un manejo apropiado de las TIC ejercen un efecto pares protector de la repetición. Por su parte, los malos hábitos alimenticios generalizados o excesivas obligaciones en las labores del hogar destacan

como factores de riesgo que muestran efecto pares. El impacto que alcanza este efecto pares sobre la repetición hace replantearse las estrategias aplicadas en el sistema educativo para promover el **éxito** escolar.

Palabras clave: Repetición de curso, factores no cognitivos, factores contextuales, regresión logística multinivel, educación secundaria obligatoria.

Introduction

Grade repetition is a complex phenomenon that can be analysed from different perspectives and distinct levels (Bronfenbrenner, 1979). The first level of analysis (*exo-macro*) refers to factors at higher levels that the school students attend and that surround and envelope their reality. Issues such as state organisation, geography, demography, cultures or education policies can be found in this level of analysis, which enables us to study differences between countries and regions, and research associated factors. An intermediate (*meso*) level features factors associated with schools and/or classrooms, including the characteristics of the school, teacher beliefs, teacher-student relationship, etc. Finally, at individual (*micro*) level, we find contextual, cognitive and non-cognitive student characteristics (Fonteyne et al., 2017).

Thus, based on the CIPO model (Scheerens, 1990), the output (in this case, grade repetition) causes contextual factors (demographic, biological, cultural and socioeconomic inputs of students and their surroundings), non-cognitive factors such as attitudes, beliefs, personality, social and emotional qualities or learning processes (Fonteyne et al., 2017) and cognitive factors[1] (mental and intellectual processes).

Considering that recent papers delve into grade repetition at exo-macro levels in the context of Spain (Nieto-Isidro & Martínez-Abad, 2023), this study proposes advancing in knowledge of factors associated with grade repetition at school and student levels (*meso* and *micro*) based on the CIPO model. Another fundamental contribution of this research is to study the "peer effect" on grade repetition. This effect refers to the influence that group characteristics exercise on individual outputs. While there is a wealth of literature on the peer effects on academic performance (Paloyo, 2020), no proposals include

1 As PISA 2022 does not include information on student cognitive factors, this study focuses on contextual and non-cognitive factors.

grade repetition in the prediction. This effect will be studied by aggregating individuals scores in student context and non-cognitive factors at school level (Gamazo et al., 2018).

Data from the Organization of Economic Cooperation and Development (OECD) PISA 2022 assessment will be used for this study. Applying multi-level logistic regression models will be proposed for a multivariate analysis of the phenomenon of grade repetition, taking into account the existing interrelationship between meso- and micro-level factors.

Cultural, socioeconomic and political components of repetition

Grade repetition can be studied from a *macro* level, i.e., from a perspective of countries or regions, considering two aspects: the existence of political, cultural and social components that favour the maintenance of grade repetition and justify its presence in education systems; and the educational, economic and social consequences of repetition at country or region level.

In view of international assessments, it is clear that the percentage of students repeating grade varies greatly from country to country. In the specific case of the European Union, grade repetition policies vary greatly by country, from those that do not contemplate this option in legislation with automatic promotion during compulsory schooling, to countries with a high rate of repetition such as Spain (García-Merino et al, 2024). The 34-country study by Goos et al (2013), using data from PISA 2009, TALIS 2007 and education policy reports drafted by the OECD, also shows that up to 25% of grade repetition variability is at country/region level. Goos et all (2021) state that there is a cultural, social component that contemplates repetition as one of the valid tools in education systems to ensure students acquire the necessary knowledge and skills. On the other hand, repetition has consequences on educational, economic and social structures in countries and regions: repetition has been linked with academic failure, dropping out and less choice of university studies, as highlighted in various studies focusing on Spain (Calero et al, 2010; Calero et al, 2012; Choi, 2018; López-Rupérez et al, 2021; Suberviola, 2025) and other countries, for example Contini and Salza (2024) in Italy, Hughes et al (2028) and Jacob and Lefgren (2009) in the United States or Van Canegen et al (2023) in Belgium. Also, from a macro-level education policy-maker perspective, grade repetition is a highly ineffective

measure from an economic point of view as it increases the cost of education and increases inequality (Calero et al,2012; López-Agudo et al 2014; López-Rupérez, 2021; OECD, 2011).

In the specific case of Spain, the study of factors related with repetition from a *macro* perspective at regional level has been addressed by the authors in a previous study (Nieto-Isidro & Martínez-Abad, 2023) in which the rate of repeaters in schools given by PISA 2018 is related with variables at Autonomous Region level linked to socioeconomic factors, indicators of wealth and spending on education, quality of life indicators and indicators of economic inequity or inequality, showing that there are significant differences between the various Autonomous Regions. This *macro* level will therefore not be the subject of this study; we will mainly concentrate on *meso* (school) and *micro* (student) levels.

Repetition and schools

Secondly, a *meso* level can be defined related to schools, analysing their contextual, socioeconomic and educational characteristics that may be relevant to repetition. In the context of Spanish education, school characteristics have been included in various research projects, but they have generally focused on variables such as performance, academic failure, educational equity, school effectiveness, etc., and not directly on repetition, the subject of this study. Moreover, the outcomes of the papers that could be cited are not conclusive: for example, Nieto-Isidro and Martínez-Abad (2023), using data from the Spanish PISA 2018 sample, show that various school characteristics such as socioeconomic level, ownership, town and school size, or percentage of men and immigrants, are related with their repeating student rate. However, in the study by Cordero et al. (2014), with PISA 2009 data, school-level variables have no significant effect on grade repetition, except for the concentration of immigrant students in the classroom when they exceed 30%. According to Pedraja et al. (2016), with PISA 2003 and 2009 data, the proportion of immigrant students by school affects the immigrant students themselves —leading to a higher rate of repetition— but not the native students if the concentration of immigrants is below 15%. Considering academic failure instead of repetition, the paper by Calero (2010) shows a significant relationship between academic failure and the proportion of immigrant students in the school when this concentration exceeds 20% of the student body; while the proportion of girls and educational level of parents act as protective factors.

How school characteristics affect repetition is also underlined in some studies in other countries: the most consistent outcome is the relationship between average school socioeconomic level, as in the study by Ferrão et al (2017) with PISA 2012 data in Brazil. The international review study by López et al. (2023) also identifies a low socioeconomic level and high percentage of immigrants as the most important school factors linked with repetition in public schools.

Repetition and student characteristics

Finally, at *micro* level, it is important to determine which personal, family or contextual characteristics are related with grade repetition. As for contextual characteristics of repeating students, research in Spain shows mainly that gender (boy), birth month (born at the end of the year), immigrant status and, above all, family socioeconomic level (lower socioeconomic status) are risk factors related with repetition, as indicated in studies by Choi et al. (2018) or Cordero et al. (2014), who add not enrolling in early childhood education. In the recent study by Álvarez-García et al. (2024) with data from the Spanish PISA 2022 sample, the group of students with a higher rate of repetition is largely formed by first- and second-generation immigrants who also have a low socioeconomic level and weaker family and social support networks.

These outcomes obtained with data from Spain are corroborated by different studies on repetition in other countries: for example, in a longitudinal study by Contini and Salza (2024) in Italy, repeating students are mostly male, immigrants and with parents with a low level of studies. Likewise, the longitudinal study by Klapproth and Schaltz (2015) with students from Luxembourg, adds following a lower academic path to the factors of gender, nationality and socioeconomic status. Goos et al. (2013) with PISA 2009 data in the 24 OECD countries, also find a direct relationship between grade repetition and gender (male), being an immigrant, low level of parent studies and language spoken at home. However, in the study by Ikeda and García (2014) with the same PISA 2009 data, the relationship between repetition and socioeconomic status is heterogeneous in the 30 countries analysed; the same occurs with the relationship between repetition and gender, immigration status or age. López et al. (2023) find a series of student-level variables linked with repetition; some are contextual, such as gender or being an immigrant, and others non-cognitive, like motivation problems and frequently playing video

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games. An inverse relationship between using computers for homework is also observed and a direct relationship with not having their own computer and having lower educational expectations to continue studying.

Among the non-cognitive factors, there is solid evidence that links repeating with educational and/or job expectations. In the case of Spain and with PISA 2015 data, Choi (2018) has demonstrated not only the role that academic expectations play on academic performance, but the relationship between these aspirations with family socioeconomic factors and with peer expectations, as well as the inverse relationship between grade repetition and expectations to complete higher studies and the direct relationship with expectations of abandoning the education system early. Also with PISA 2015 data in Spain, the study by Arroyo et al. (2019) indicates that students with lower educational aspirations are more likely to repeat. An analysis by Constante-Amores et al. (2022), with PISA 2018 data from Spain, points out that expected student status is a significant predictor of grade repetition both in primary and compulsory secondary education. In the study mentioned by Álvarez-García et al. (2024) with the Spanish PISA 2022 sample, the group of students with a higher rate of repeaters also has lower future aspirations.

Is repeating beneficial for students?

Scientific research on the possible benefits or detriments of repeating is far from conclusive and depends greatly on the methodological quality of the studies (Allen et al., 2009).

By analysing the effect of repeating on performance, one of the difficulties found is the difference between comparing repeating students with their classmates (younger) or comparing them with their peers (a grade higher). Thus, Bonvin et al. (2008) found a positive effect in short- and medium-term performance in primary education students in Switzerland when comparing students of the same level, but the effect is negative when comparing students of the same age. In a longitudinal study, Wu et al. (2008) also found interesting effects: repeating students, when compared with their peers of the same age, show lower short-term performance in mathematics and reading, but this performance is higher in the long term, while if compared with students in the same grade, increased performance is higher in the short term but reduces in the long term.

Some longitudinal studies show certain positive effects of repeating, with a slight increase in academic performance that generally drops over time

(Allen et al., 2009; Klapproth et al., 2016; Marsh, 2016). Many voices both in Spain (Calero et al, 2010; Calero et al., 2012; Choi et al., 2018; León & Martínez-Abad, 2025; López-Agudo et al., 2024; Rodríguez, 2022; Rodríguez & Batista, 2021) and in other countries (Allen et al., 2009; Bonvin et al., 2008; Contini & Salva, 2024; Ehmke et al., 2010; Lamote et al., 2014, OECD, 2011) point to repeating a grade as an ineffective method for improving medium- and long-term student performance (Goos et al., 2021; Valbuena et al., 2021).

Studies on the relationship between repeating and non-cognitive variables also show a negative effect. In Spain, the study by Rodríguez and Batista (2021) with compulsory secondary education students in the Canary Islands, found a lower academic self-concept in repeating students compared to those who did not repeat; the study by León and Martínez-Abad (2025), with data from the Spanish PISA 2022 sample, shows a negative causal effect of repetition on student mathematical self-efficiency.

These same results are reproduced in other countries. Martin (2011) uses Australian students to show the relationship between grade repetition and lower academic motivation, engagement and self-concept, as well as the negative effects in relations with classmates and self-esteem; Peixoto et al. (2916) also found a drop in academic self-concept and self-esteem among repeating Portuguese students compared to their non-repeating peers. The study by Klapproth et al. (2016) with secondary students in Luxembourg found a slight decrease in the self-esteem of repeating students compared to their non-repeating classmates. In the longitudinal study by Kretschmann, et al. (2019) with German compulsory secondary education students found no improvement in student academic self-concept after repeating.

Other studies report beneficial outcomes of repeating at short-term, non-cognitive level: Ehmke et al. (2010) with secondary students in Germany found positive effects one year later in the mathematical self-concept of repeating students; Bonin et al. (2008) found a rise in academic self-concept, social acceptance and attitudes towards school in repeating students in Switzerland when compared to low-performance students passing grade, although this effect diminishes over the academic year. Meanwhile, when studying mathematical self-concept with PISA 2003 data in 41 countries, Marsh (2016) found a positive effect in the case of repeating grade and negative for moving up a grade. In the paper by Pipa et al. (2023) with Portuguese students, repeating students show no difference in self-esteem or short-, medium- and long-term aspirations; they do, however, show a short-term increase in academic

self-concept that drops over time. This short-term rise in self-concept is also an outcome of the study by Lamote et al. (2014) with secondary students in Belgium.

Study objectives

Although studies on factors associated with repeating in Spain are numerous, they fundamentally focus on detecting contextual factors at school and student levels. However, while literature on the effect of non-cognitive student factors is more limited, few studies are available that pay attention to the role peers play in grade repetition. So the primary objective of this study is to analyse the relationship between the main contextual and non-cognitive personal factors and grade repetition, differentiating between the effect of these factors on repetition at individual student level and the peer effect exerted by the characteristics of their classmates.

The specific study objectives are:

1. Analyse individual contextual and non-cognitive factors related with grade repetition.
2. Study the effect that the characteristics of the student's classmates has on the likelihood of them repeating grade (peer effect).

Method

Secondary quantitative analyses were applied using PISA 2022 databases following a positivist research approach. PISA is the most important large-scale assessment worldwide in terms of number of participating countries. It allows us to monitor and compare the quality, equity and efficiency levels of national education systems (OECD, 2022), establishing a competency-based approach when measuring academic performance (OECD, 2023). Given that PISA tests offer panel data of participating countries every three years, a non-experimental, cross-sectional **design** was used to analyse panel data.

Population and sample

Based on the population of 15-16-year-old students at Spanish schools offering compulsory secondary education, a sample of n=30,800 students and m=966 schools was included.

PISA 2022 ensures population representativeness by applying stratified probability sampling (by ownership and subregion) by clusters (schools) in two stages with probabilities proportional to size. In fact, the Spanish sample was the largest of all countries assessed in PISA 2022 as it included representative samples for each autonomous region and city. Table I shows sample distribution by some characterisation variables.

TABLE I. Sample characterisation

Variable	Distribution
Grade repetition (REPEAT)	Never repeated: 78.3%
	Repeated at least once: 21.7%
Gender (GENDER)	Woman: 49.5%
	Man: 50.5%
Immigration status (IMMIG)	Native: 84.9%
	Second-generation immigrant: 8.8%
	First-generation immigrant: 6.3%
Skipping class (SKIPPING)	No class skipped (last two weeks): 58.1%
	At least one class skipped (last two weeks): 41.9%
Late for class (TARDYSD)	Always on time (last two weeks): 59.7%
	Occasionally late (1-2 times in last two weeks): 26.1%
	Frequently (3 or more times in last two weeks): 14.2%
Academic expectations (EXPECEDU)	Compulsory secondary education: 4.2%
	Intermediate VT: 3.6%
	Baccalaureate: 13.0%
	Advanced VT: 13.0%
	Undergraduate degree: 18.0%
	Master's degree: 28.1%
	Doctoral thesis: 20.0%

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Job prospects (SISCO)	No clear idea about future work: 15.2% Clear idea about future work: 84.8%
School ownership (SCHL-TYPE)	Public school: 58.1% State-subsidised private school: 31.5% Private school: 10.4%

Source: Prepared by authors

Variables and instruments

Given the secondary nature of this study, instrumentation for obtaining outcomes is defined and implemented by the OECD. While some variables included are simple indicators obtained directly from the context questionnaires applied, others are compound factors obtained from blocks of items applied to students and management teams. The full instrumentation and items including compound factors are explained in detail in the OECD *Assessment and Analytical Framework* (2023) and *Technical Report* (2022). The complete list of variables used, selected from prior literature (Gamazo et al., 2018; Nieto-Isidro & Martínez-Abad, 2023), is available in Online Appendix I.

More specifically, in this study we can differentiate between criterion and predictor variables:

- Student's grade repetition status was used as a criterion variable (*REPEAT* in PISA). This variable is dichotomous, with values 0 (non-repeater) and 1 (has repeated at least one grade).
- Relevant contextual variables (gender, immigration status, socioeconomic level, school ownership, student-teacher ratio, school resources available, etc.) and non-cognitive variables (academic and job expectations, class attendance, school climate, socio-emotional skills, use of ICTs, personal well-being, etc.) were included as predictor variables to respond to the objectives proposed.

Procedure and data analysis

The analytical approach of this study was correlational. Given the high initial number of variables, a bivariate correlational analysis between grade repetition and the set of explanatory variables at student and school level was first conducted. Thus, the subsequent multiple regression model only included

variables relevant to the study.

Three aspects of the databases had to be pre-processed before applying statistical techniques:

1. Standardisation of all scale variables available to a Z(0,1) distribution. This unifies interpretation of the parameters of logistic regression models obtained, simplifying their understanding.
2. Transformation of available polytomous variables into dichotomous (dummy) variables[2]:
    - Immigration status:
        - IMMIG (natives): 0=1st and 2nd generation immigrant; 1=Native.
        - IMMIG (immigrants): 0=Native and 1st generation Immigrant; 1=Native.
    - Late for class:
        - TARDYSD (never): 0=Sometimes and frequently late; 1=Always punctual.
        - TARDYSD (frequent): 0=Always punctual or sometimes late; 1= Frequently late.
    - School ownership:
        - SCHLTYPE (public): 0=State subsidised and private; 1=Public.
        - SCHLTYPE (private): 0=State subsidised and public; 1=Private.
3. Give the known *peer effect* that peers exert on student academic performance (Gamazo et al., 2018) and the relevance of school-level factors on grade repetition (Nieto-Isidro & Martínez-Abad, 2023), aggregate average values at school level of all student-level variables included in the study were added to the final database.

With the final database, the percentage of repeating students in Spain was analysed by autonomous region in PISA 2022 compared to PISA 2018 to obtain an initial descriptive approximation to the problem of repeating grade in Spain.

Correlations between grade repetition and the set of predictor variables at both student and school level were then obtained; only predictor variables with significant correlations and non-trivial relationship effect sizes —

2 Despite its ordinal nature, as 7 clearly staggered levels are included, the Academic expectations (EXPECEDU) variable is considered to be a scale variable in analyses.

over .1— were selected for the subsequent multi-level logistic model. The point-biserial correlation was obtained in the case of scalar predictor variables and the phi correlation for dichotomous predictor variables.

Finally, binary logistic multi-level regression models (*logit*) were applied considering student (L1) and school (L2) levels. The backward stepwise regression technique was applied to obtain fully significant models, eliminating the non-predictor variable with the lowest weight (smallest t value) on the criterion variable in each iteration.

Specifically, two models were obtained:

1. Contextual model: formed exclusively by significant contextual predictor variables. Included as a baseline to initially control contextual effects associated with grade repetition.
2. Complete model: including contextual variables from the previous model and other non-cognitive variables identified in the prior correlational analysis.

Based on proposals from previous studies that apply multi-level models from PISA data (Gamazo et al., 2018) and considering the high number of predictor variables in the model, multi-level models with fixed slopes and random intercepts were obtained. This decision simplifies model calculation and interpretation, however its main limitation is that it assumes that the effective of predictor variables is constant across schools. The Intraclass Correlation Index (ICI) is also obtained from the null multi-level regression model to assess the suitability of multi-level model calculation. ICI reports on the percentage of total variance of the criterion variable explained by how subjects are grouped in schools. Taking into account recommendations from reference works (Lee, 2000), a minimum ICI of 10% is set to consider multi-level model application as suitable.

For easier interpretation of the logistic regression model, odds ratios (OR) were transformed to report on the proportion increase of likelihood of repeating by increasing the predictor variable by one POR unit. In the case of ORs under 1 (predictor variable with inverse effects), proportion values were reported as negative. They were transformed as follows:

- If OR>1 → POR= OR-1
- If OR<1 → POR= -[(1/OR)-1]
- If OR=0 → POR= 0

Model fit quality was assessed using information from the confusion matrix, which reports observed and predicted values. The overall accuracy percentage of the model was reported using this table, understood as the relationship between total accurate predictions (true positives and negatives) and total cases.

Since PISA includes a complex sample design (OECD, 2022), available sample weights had to be taken into account in estimates. School-level weights were included based on recommendations by Jakubowski et al. (2022).

All analyses were run using SPSS software (v.23) and starting with a significance level of 5%.

Results

According to PISA 2022 data, students in the Spanish sample have a grade repetition rate in the 2022 wave of 21.7%. This figure is a slight improvement compared to the PISA 2018 rate, which was 28.7%, but continues to rank Spain fourth in repetition percentage only behind Colombia, Belgium and the Netherlands and far exceeding the OECD average of 9.1%.

Figure 1 shows the percentage of repeating students by Autonomous Region in the last two PISA waves (2018 and 2022). The greatest reductions can generally be observed in Regions that already had the lowest levels in 2018, increasing the gap between regions, especially compared to the autonomous cities of Ceuta and Melilla where the percentage rises considerably.

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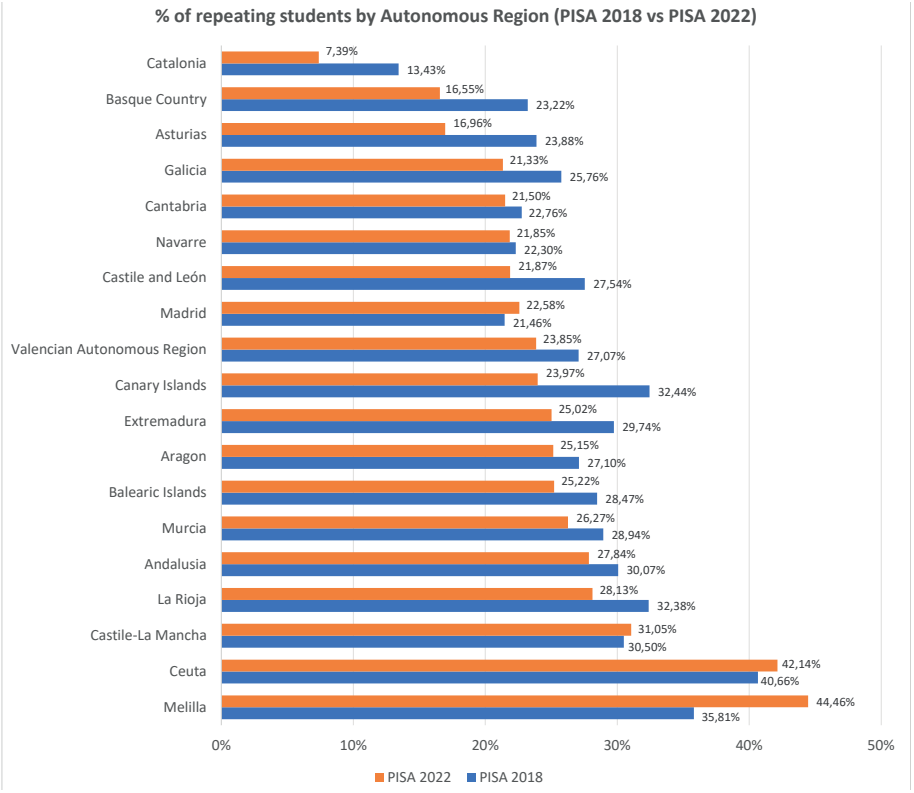
FIGURE I. Percentage of repeating students by Autonomous Region in Pisa 2018-2022



Source: Prepared by authors based on PISA data

Correlational study results

Table II shows the significant bivariate correlations obtained between grade repetition and the student's personal contextual factors at both individual (L1) and school level (L2) where at least one is of high intensity: the full table is available in Online Appendix II. More intense correlations in L2 than L1 can generally be observed in Table I. In other words, student contextual factors aggregated to L2 generally have a more important association effect on grade repetition rate in the school than the student's personal factors on their own likelihood of repeating.

Of all the variables included, only two show moderate or high inten-

sity associations at both student and school levels: immigration status (IMMIG) and socioeconomic level (ESCS). While lower socioeconomic levels are clearly associated with grade repetition, being an immigrant is also linked to repeating.

Notable correlations can be observed at school level in the case of gender and age. While schools with a higher proportion of women have a lower rate of repeating students, a higher proportion of younger students is associated with a higher grade repetition rate.

TABLE II. Bivariate correlation between grade repetition and personal contextual variables

Student contextual variables	**Personal level (L1)**	**School level (L2)**
Gender (GENDER)	.079*	.330
Age (AGE)	-.073*	-.126
Immigration status (IMMIG)	.160	.243
Socioeconomic level (ESCS)	-.322	-.542
ICTs available in the school (ICTSCH)	.008*	.113
ICTs available in the home (ICTHOME)	-.069*	-.222
Quality of ICT access (ICTQUAL)	-.038*	-.154
Body mass (STUBMI)	.086*	.396
COVID-19 problems (PROBSELF)	.074*	-.150

* Very low-intensity correlation
Source: Prepared by authors

Table III shows significant bivariate correlations obtained between grade repetition and moderate or high-intensity school level contextual factors[3]. As for school ownership (SCHLTYPE), repeating is less common in private and state-subsidised private schools than in public schools. The remaining factors associated with a lower repetition rate in schools is: a greater proportion of teachers with a PhD (PROPAT8), higher number of support teachers (PROPSUPP) and better preparation for digital learning (DIGPREP).

3 Full table available in Online Appendix II.

TABLE III. Bivariate correlation between grade repetition and school contextual variables

Student contextual variables	**School level (L2)**
School ownership (SCHLTYPE)	.171
Teachers with PhD (PROPAT8)	-.107
Support teachers (PROPSUPP)	-.122
Preparation for digital learning (DIGPREP)	-.120

Source: Prepared by authors

Table IV shows bivariate correlations between grade repetition and non-cognitive personal factors in L1 and L2, where at least one of the two levels has moderate or high-intensity associations[4]. Non-cognitive variables have a less intense and clear trend than contextual variables in their association with grade repetition.

So, some factors such as bullying suffered (BULLIED), perseverance (PERSEVAGR) or academic support from family (FAMSUP) exert a significant effect at student level but very low or insignificant at school level. The different variables linked with handling ICTs (ICTFEED, ICTWKEND, ICTWKDY, ICTREG) appear to have more important effects at school level than student level, as do other variables such as assertiveness (ASSERAGR), physical exercise (EXERPRAC), doing homework (STUDYHMW) or job expectations (SISCO). Meanwhile, other variables affect student and school level to a similar degree, such as skipping classes (SKIPPING) or being late (TARDYSD), doing household chores (WORKHOME) or connection with the family (SOCONPA). Academic expectations (EXPECEDU) is the non-cognitive variable with the greatest bivariate association with repeating at both student and school level. The association is very intense at school level, therefore, schools where the academic expectations of students are generally high clearly have a lower repetition rate.

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TABLE IV. Bivariate correlation between grade repetition and non-cognitive variables

Non-cognitive variables	Personal level (L1)	School level (L2)
Skipping class (SKIPPING)	.113	.145
Late for class (TARDYSD)	.145	.196
Exercise (EXERPRAC)	.068*	-.199
Homework (STUDYHMW)	-.038*	-.144
Household chores (WORKHOME)	.103	.154
Academic expectations (EXPECEDU)	-.274	-.573
Job prospects (SISCO)	-.027*	.126
Bullying suffered (BULLIED)	.109	-.039*
Perseverance (PERSEVAGR)	-.116	-.068*
Assertiveness (ASSERAGR)	-.078*	-.317
Academic support from family (FAMSUP)	-.112	-.002**
Feedback by ICT (ICTFEED)	-.025*	-.255
ICT use for leisure at weekend (ICTWKEND)	.079*	.092
ICT use for leisure during week (ICTWKDY)	.112	.234
School ICT regulation (ICTREG)	-.027*	-.128
Connection with family (SOCONPA)	-.116	-.175

* Very low-intensity correlation
**Insignificant correlation
Source: Prepared by authors

Multi-level analysis results

Note that initially more than 15% of variability of the repeater variable can be explained by student grouping in schools (ICI=15.21%), so it is appropriate to create a multi-level model including school-level variables.

As for the multi-level models applied (Table V), the initial contextual model, which only includes student contextual variables in L1 and aggregated to L2, mainly maintains variables added to L2, except immigration status (which only affects L1) and socioeconomic level (with significant effects in both levels). There is therefore a clear peer effect in explaining grade repetition, which emerges along with the significant known effects of individual student characteristics, fundamentally contextual.

As expected, personal contextual variables have the highest effect on grade repetition in the complete model, primarily family socioeconomic level (ESCS), which significantly reduces the likelihood of repeating; a single-unit increase in this variable reduces likelihood by 65.3%. Immigrant status (IMMIG) is another high-impact factor; if all other variables remain stable, immigrant students are 67.6% more likely to repeat than other students.

As noted above, a relevant finding is the importance of peer effect in grade repetition as numerous student contextual variables aggregated in L2 have significant effects, such as proportion of male students (GENDER), which potentially increases likelihood of repeating by more than 10% at individual level. Other variables exerting an interesting peer effect seem to indicate a direct link between grade repetition and school contexts with bad eating habits (STUBMI) or an inverse association with the students' average month of birth (AGE). As for purely school contextual variables, first we find that school ownership (SCHLTYPE) has practically no effect in the complete model. On the other hand, teacher training (PROPAT8) and school preparation for digital teaching (DIGPREP) appear to be factors that protect from grade repetition.

Non-cognitive factors include important factors associated with a higher risk of grade repetition, such as the student's obligations at home (WORKHOME), bullying suffered (BULLIED) or daily ICT use for leisure activities (ICTWKDY). The main factors that protect from grade repetition are punctuality (TARDYSD-never), not skipping class (SKIPPING-never), student's own academic expectations (EXPECEDU), academic support from family (FAMSUP) and perseverance (PERSEVAGR).

Interesting peer effects can also be found in non-cognitive factors that exercise a protective peer effect against grade repetition. Mainly: general educational expectations, punctuality, physical exercise (EXERPRAC), good student relationships with their families (SOCONPA) and general levels of assertiveness (ASSERAGR) among students. Other protective factors aggregated at school level including the use of ICTs to give students feedback (ICTFEED) and clear regulation on ICT use in school (ICTREG), as well as use of ICTs for leisure activities restricted to the weekend (ICTWKEND).

At the other end of the spectrum we find aggregated non-cognitive factors that increase the risk of grade repetition. This is the case of excessive homework (STUDYHMW), a significant proportion of students with household obligations and the use of ICTs for leisure on school days (ICTWKDY).

TABLE V. Multi-level logistic regression (logit) models

	Contextual model			Complete model		
	t	**P**	**POR***	**t**	**P**	**POR***
Intercept	-36.443	<.001		-30.161	<.001	
L1-IMMIG (natives)	-15.288	<.001	-.448	-16.184	<.001	-.607
L1-IMMIG (immigrants)	14.410	<.001	.597	12.876	<.001	.676
L1-ESCS	-78.998	<.001	-.837	-54.768	<.001	-.653
L1-GENDER (aggr.)	17.600	<.001	.131	10.971	<.001	.107
L1-AGE (aggr.)	-14.053	<.001	-.106	-5.393	<.001	-.049
L1-ESCS (aggr.)	-11.205	<.001	-.110			
L1-ICTSCH (aggr.)	14.283	<.001	.131	13.090	<.001	.123
L1-ICTHOME (aggr.)	-3.385	.001	-.026			
L1-ICTQUAL (aggr.)	-2.633	.008	-.022	9.361	<.001	.116
L1-STUBMI (aggr.)	24.246	<.001	.191	8.919	<.001	.090
L1-PROBSELF (aggr.)	-10.496	<.001	-.071	-6.800	<.001	-.069
L2-SCHLTYPE (public)	10.321	<.001	.206	-2.369	.018	-.055
L2-PROPAT8	-16.657	<.001	-.147	-7.395	<.001	-.077
L2-PROPSUPP	-3.990	<.001	-.031			
L2-DIGPREP	-8.207	<.001	-.070	-5.570	<.001	-.058
L1-SKIPPING (never)				-16.217	<.001	-.335
L1-TARDYSD (never)				-20.417	<.001	-.515
L1-TARDYSD (frequent)				4.225	<.001	.123
L1-WORKHOME				33.156	<.001	.349
L1-EXPECEDU				-53.563	<.001	-.572
L1-BULLIED				17.112	<.001	.164
L1-PERSEVAGR				-10.302	<.001	-.110
L1-FAMSUP				-13.503	<.001	-.127
L1-ICTWKDY				18.307	<.001	.202
L1-TARDYSD (aggr.)				-4.310	<.001	-.048
L1-EXERPRAC (aggr.)				-9.356	<.001	-.085
L1-STUDYHMW (aggr.)				13.614	<.001	.142
L1-WORKHOME (aggr.)				2.379	.017	.024
L1-EXPECEDU (aggr.)				-17.317	<.001	-.212
L1-ASSERAGR (aggr.)				-17.414	<.001	-.195

L1-ICTFEED (aggr.)				-19.459	<.001	-.268
L1-ICTWKEND (aggr.)				-11.337	<.001	-.202
L1-ICTWKDY (aggr.)				10.347	<.001	.194
L1-ICTREG (aggr.)				-3.169	.002	-.029
L1-SOCONPA (aggr.)				-4.158	<.001	-.047

* Proportion increase in the likelihood of repeating by increasing the predictor variable by 1 unit.
Source: compiled by authors

Both models had a good fit (Table VI) with prediction accuracy levels over 80% in both cases, although the complete model achieved significantly higher overall accuracy than the contextual model. Specifically, while the true negative rate (specificity) is around 98% in both models, the true positive rate (sensitivity) increases from just over 12% in the contextual model to almost 20% in the complete model. This low level of sensitivity is because the percentage of repeating students represents approximately one fifth of all students in the sample used, which makes it difficult to identify these subjects in the model.

TABLE VI. Regression model confusion matrix

Observed scores		**Contextual model**		**Complete model**	
		Predicted scores		**Predicted scores**	
		Non-repeater	**Repeater**	**Non-repeater**	**Repeater**
Non-repeater	Freq.	125701	2862	107292	2533
	rows %	97.8%	2.3%	97.7%	2.3%
Repeater	Freq.	25851	3573	16471	4009
	rows %	87.9%	12.1%	80.4%	19.6%
Accuracy		81.8%		85.4%	

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Conclusions

The main goal was to study the relationship between contextual and non-cognitive factors and grade repetition in secondary education in Spain, distinguishing between the direct effect these factors exert at student level (L1) and the peer effect, i.e., the effect mediated by the contextual and non-cognitive characteristics of classmates. Our results indicate that, in addition to the great importance of individual factors already studied in prior literature such as family socioeconomic and cultural level, peer effect exerts a key influence on grade repetition. In view of the importance given to this matter in prior literature, we understand it to be the primary contribution of this paper.

A series of individual contextual and non-cognitive factors are related with the likelihood of repeating grade. Contextual variables include socioeconomic level and immigration status. Based on our results, gender is not associated with grade repetition in Spain —at least at individual level—, the same as ICTs available in school or in the home. In this sense, there are some discrepancies with the recent study by Álvarez-García et al. (2024), which uses a data mining analytical approach and in which socioeconomic status and ICT use in the home and at school are the three main predictors of categorisation of Spanish students who completed PISA 2022. These discrepancies may be because the study by Álvarez-García et al. (2024) focuses on student grouping by similar profiles and not on identifying factors associated with grade repetition.

As for individual non-cognitive variables, the most important variables that protect from grade repetition are academic expectations, punctuality and attendance, and not having a significant load of household chores. In line with Álvarez-García et al. (2024), these results along with other, less relevant associated factors such as family support and control of ICT use for leisure at the weekend reveal how important it is for the student to be surrounded by a stable, motivating family environment that favours their personal and academic development and actively controls their academic activities.

When analysing the role of schools, the most significant contribution of this study is ascertaining that there is a significant peer effect on grade repetition in compulsory secondary education in Spain. Along with immigration status, socioeconomic level, academic expectations and attendance —variables with significant effects at student level—, aggregated school characteristics have a major link with the likelihood of repetition. This result, which apparently contradicts the results obtained by Constante et al. (2024), where

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individual variables gained a much higher weight than school variables in predicting grade repetition, is explained because these authors did not aggregate L1 variables at school level. In fact, this interpretation is reaffirmed when taking into account that student grouping by school explains more than 15% of total grade repetition variability in our study. So our results confirm that, while factors exclusive to the school level (such as ownership, teacher training or support teacher availability) are marginally associated with grade repetition (Constante et al., 2024), there are school environments related with general student characteristics that exert a protective or risk effect on a student repeating a grade.

The main individual contextual characteristics that exert a peer effect on grade repetition when aggregated, with effects superior to school contextual characteristics, are the proportion of male students, presence of ICTs in the school and school activities, and bad student eating habits. These results delve deeper into the claims made by authors such as Choi (2018) who, with regard to the association between gender and grade repetition, state: not only is being male directly associated with grade repetition, but being in a school with a higher proportion of male students is associated with a higher individual likelihood of repeating a grade, regardless of the student's gender. Evidence on the peer effect of using ICTs and diet are new additions and open up new lines for future research.

As for aggregated non-cognitive variables, academic expectations again play one of the most relevant roles. Not only are personal expectations associated with repetition (Choi, 2018), but attending a school where students have low aggregate expectations increases the likelihood of grade repetition. Again we find factors linked with ICT use, although in this case with controversial results that merit more in-depth analysis in future studies: while contexts with widespread use of ICTs for leisure during the week individually increase the likelihood of grade repetition, school environments that generally use them at the weekend and to receive academic feedback from teachers exert a protective effect at individual level. This once again reveals the importance of effective parental control and support (Álvarez-García et al., 2024) and that ICT use in school is a resource for learning rather than an end in itself (Alé-Ruiz et al., 2024).

In summary, although the results obtained are in line with the literature review regarding individual factors associated with grade repetition, the fundamental development of this study is that it reveals a significant peer effect associated with grade repetition in Spain. In line with prior studies that

already pointed to this peer effect in relation to aggregated contextual factors (Ferrão et al., 2017; López et al., 2023; Nieto-Isidro & Martínez-Abad, 2023), our paper adds that aggregated non-cognitive characteristics of a school's students also exert this effect and with even more intensity than the peer effect observed in contextual factors.

The results of this study encourage us to reflect on whether grade repetition is the most appropriate measure to compensate for academic difficulties and how to use **healthy** school environments to develop the maximum individual potential of each and every student in our education systems.

Limitations and future studies

The main limitations of this study are related with the characteristics of PISA studies (González-Such et al, 2016; Jornet, 2016). Firstly, unlike other international assessments such as TIMSS or PRILS, PISA tests do not identify the student's classroom level, which makes it difficult to properly characterise the student's school environment. This limits the results obtained on the peer effect and future research is necessary on these results with more systematic data. Another essential issue is the cross-cutting nature of PISA assessments. Longitudinal student and school monitoring is not possible as PISA offers 3-yearly panel data, which limits the analysis of non-cognitive factor evolution when grade repetition occurs, making it impossible to draw causal conclusions. Finally, PISA also suffers from limitations in the context questionnaires used. In addition to being self-reported questionnaires, linked to problems of social desirability, given their length and scope, they attempt to measure complex traits and factors with a very limited number of items, affecting their validity.

The specific limitations of this study include that only data from the Spanish sample were used given the particular prevalence of grade repetition in our education system. This may make it difficult to generalise results. Also, variables were pre-selected due to the volume of variables available in PISA 2022. Furthermore, PISA 2022 does not include information on cognitive factors such as intelligence or basic psychological processes so some relevant variables may have been omitted, an issue that can be addressed in future studies.

Taking into account these results and current debate on the use of ICTs in education, future studies on the role of ICTs in repetition would be of unquestionable interest as their individual and aggregated effects are unclear in

this study. Future longitudinal studies that focus on studying how the change in group levels of non-cognitive factors whose peer effect has been detected in this study individually affect grade repetition are also recommended.

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