WHY DO BOYS PERFORM WORSE THAN GIRLS IN READING LITERACY? EVIDENCES FROM PISA SURVEY 2018

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1 Introduction

The reading gender gap is little studied and explored even though it is much higher than math gender gap, on which instead there is a wider literature and greater political attention, as such a gap affect the quality of women's education and on the choice of their career paths (Mostafa, 2019). The boys' underachievement in reading and lower reading engagement relative is typical of all countries that participate in the OECD's Programme for International Student Assessment (PISA) tests, since the first assessment in 2000 (OECD, 2019). The importance of increasing the competence and involvement of boys in reading literacy has a dual purpose, not only achieving greater equity between girls and boys, but also improve overall the basic level of reading skills regardless of the field of study or professional that students will choose. Indeed, reading literacy is an increasingly important element in a society in a rapidly changing, in which both the quantity and variety of written information are increasing and in which the ability to use, communicate and written information is critical to solving complex problems (Binkley *et al.*, 2012).

Reading literacy constitutes not only a specific subject area, but a prerequisite for understanding and communication for all educational and as well as social areas.

In the end, in the opportunity that better prepared male students could have in the choice of tertiary studies even in humanistic subjects where the male presence is small or almost non-existent.

The present study analyses the main factors behind the differences in test scores on reading literacy in Italy between male and female 15 years old students performing the Oaxaca-Blinder decomposition method (Blinder, 1973) on the data from the OECD PISA 2018 survey, in which reading was the main subject assessed.

[1] Le opinioni espresse in questo lavoro impegnano la responsabilità delle autrici e non necessariamente riflettono la posizione dell'Istituto Nazionale per l'Analisi delle Politiche Pubbliche (INAPP). Pur essendo frutto della collaborazione tra le autrici, i paragrafi 2, 3 e 4 sono da attribuire a Giovanna Di Castro e i paragrafi 1, 5 e 6 a Valentina Ferri.

The study wants to examine the weight of variables that measure the quality of the school environment, the socio-cultural context, the quality of teaching, and other non-cognitive elements that typically influence the academic success of adolescent students. The results of this study will be useful to offer indications for educational policies and practices, highlighting both those factors that feed gender inequality in boys, and those factors that in general are more related to the acquisition of reading literacy, a fundamental skill for full participation in school and social life, for which Italy is still below the international OECD average.

2 Descriptive analysis

PISA is a three-year survey that measures 15-year-old students' skills in reading, math and science. In each cycle of PISA, a subject is tested in detail, with a larger and more thorough number of items in the test.

The main subject in 2018 was reading literacy, with math and science as minor assessment areas, and saw the participation of 79 countries and education systems (Fig. 1). The PISA 2018 framework conceptualises reading as an activity where the reader interacts with both the text that he or she reads and with the tasks that he or she wants to accomplish during or after reading the text.

To be as complete as possible, the assessment covers different types of texts and tasks over a range of difficulty levels, and different types of cognitive processes

"*Reading literacy is understanding, using, evaluating, reflecting on and engaging with texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate in society*" (PISA, 2018)[2].

In PISA, the purpose is to respond to questions about texts in order to provide evidence of their level of reading literacy.

"*The reading process is assumed to be influenced by different factors related to the reader (e.g. motivation, disposition, and experience), the text (e.g., different text formats or sources), and the tasks or items (e.g., item difficulty)*" (Khorramdel *et al.,* 2020)

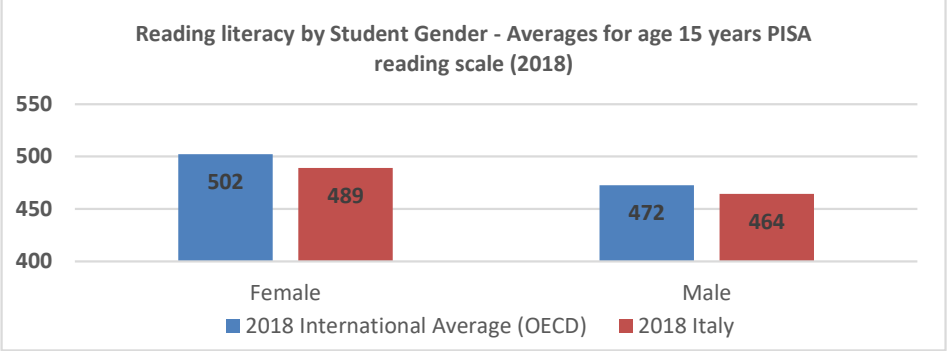
[2] Definition of reading literacy OECD (2019), PISA 2018 Results (Volume I): What Students Know and Can Do, PISA, OECD Publishing, Paris.

Figure 1 – *The countries participating in PISA survey.*

Source: OECD, 2019. PISA 2018 Results (Volume I): What Students Know and Can Do, PISA, OECD Publishing, Paris.

Analysing reading competence by student gender, we observe that the average scores of Italian women are 13 points lower than the OECD average scores. The male average is 8 points lower than the OECD average (Fig. 2).

Figure 2 – *Reading literacy by student gender.*

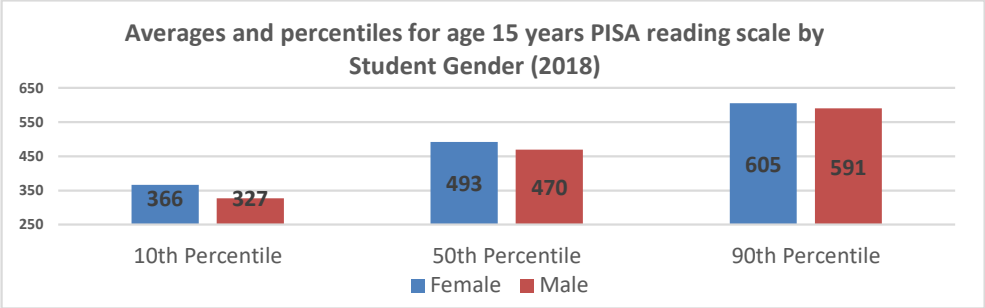


Source: Authors' elaborations on OECD-PISA 2018 data.

As for the gender gap, we observe that in Italy female have 23 points more than the male average, a difference far from small since it has been estimated that 25/30 points of difference on the PISA scale correspond to about 1 year of learning (Woessmann, 2016). That gap widens among with lower scores students, and at the

10th percentile we observe 39 points of difference while at the 90th percentile is 14 points (Fig. 3).

Figure 3 – *Gender gap in reading (10th, 50th, 90th percentile).*



Source: Authors' elaborations on OECD-PISA 2018 data.

3 Literature

Although reading literacy can be considered fundamental for learning, the difference performance between men and women has not been analyzed much (Linnakylä and Malin, 2000). A large literature, on the other hand, focuses on the analysis of the implications of the gender gap in mathematics in terms of under representation for women in math-related fields or gender inequalities in the labor market (Card and Payne, 2021). Instead, the determining factors and educational and professional implications of boys' poor reading performance are less clear.

The following studies regard the state of art of research concerning reading literacy in OECD countries.

Alvarado (2017) using the Blinder-Oaxaca decomposition on gender score gap of Colombian students in the math and reading components of the PISA 2012 test, finds that observable characteristics account for 34% in reading. This effect is due mainly to individual factors and school characteristics.

Munir *et al.* (2018) look at reading scores for all countries included in the OECD's PISA 2012 test and through decomposition methods these score differences at different percentiles of the distribution. The analysis shows that girls have a larger advantage in reading over boys. This advantage is particularly large for low-achieving individuals. Over the distribution of talent, boys' scores increase more than girls at the highest percentiles – they find a smaller reading advantage for girls.

Brozo *et al.* (2014) provide a summary of major gender differences in PISA 2009 along with relevant trends since 2000, analysing five countries: Finland, Korea, Germany, Ireland, United States. The authors' findings add further evidence to

support poor overall performance of boys and less involvement in reading than girls. They conclude with some policy implications.

Some authors have also investigated the relationship between some personality traits and performance, as well as the role played by motivational and attitudinal factors and the scores in financial literacy (another subject evaluated in the PISA tests), to explain part of the gender gap in favor of male boys in Italy, the only country where the score is significantly higher than that for girls (Longobardi, *et al*., 2018).

Some literature approaches argue that how students spend their time can affect performance, and like many other areas in adolescence, the use of free time differs widely between boys and girls (McHale *et al.*, 2001; Downey and Yuan, 2005). Boys spend more time playing video games than girls and less time reading for fun, especially complex texts, such as narrative texts (Weis and Cerankosky, 2010). Reading proficiency is very important because is the basis for other skills; when students do not read well, their performance in other school subjects is also affected (OECD, 2015).

Borgonovi (2016) suggests that the lower performance of boys in reading at the age of 15 is widespread in all the countries. She suggests an explanation linked to the habit of the boys that play video games every day more likely than girls.

The poor performance of boys in reading is lower when the assessment is provided on a computer. Boys' computer-based advantage is associated with gender differences in video games.

At the best of our knowledge, despite the importance of the reading gender gap for Italy, empirical evidence is very limited. Moreover, we observe that women perform better in reading in almost all the countries included in the PISA survey. This study allow to investigate the determinants of these differences between man and women in reading literacy that are not yet investigated in literature and in particular with regard to Italy.

4 Methodology and variables

In order to estimate the amount of the differential between male and female average wages, we have applied the decomposition of Oaxaca and Blinder (Oaxaca, 1973, Blinder, 1973). Through this method we distinguish which part is due to differences in characteristics included in model estimations and which part is due to gender "discrimination".

We estimate the twofold decomposition that divides the reading scores differences in two components: explained and unexplained.

The first component represents the explained effect (E) due to differences in the predictors; the second component (U) is the contribution of discrimination.

$$R = Q + U \quad (1)$$
$$Q = \{E(X_A) - E(X_B)\}'\beta^* \quad (2)$$
$$U = E(X_A)'(\beta_A - \beta^*) + E(X_B)'(\beta^* - \beta_B) \quad (3)$$

The equation (1) represents the twofold decomposition. The equation 2 indicates the gap in the outcome means that can be attributed to the characteristics of the groups A (male) and B (female). The equation 3 is the unexplained part. We perform the decomposition from the viewpoint of female group. Group differences in predictors are weighted by the coefficients of female's group in order to calculate the endowments effect. The variables included in our model are described in Table 1.

Table 1 – *Included variables in the Oaxaca Blinder decomposition.*

Reading score – the mean score achieved by students in reading literacy
Emosups – The index of parents emotional support
exp_par – Importance for decision about future occupation: my parents o guardians expectations about my occupation Very important (1) important (1) not important (0) somewhts important(0)
Disclima - Index of disciplinary climate
Istitut1 – general
Istitut2 – pre-vocational
Istitut3 – vocational
Age – age from 15 years and 3 completed months to 16 years and 4 completed months (14 possible options: ex. 15 years and 3 completed months; 15 years and 4 completed months; 15 years and 5 completed months)
Try_Job - Trying hard at school will help me get a good job (dummy 0/1)
Try_Coll - Trying hard at school will help me get into a good college (dummy 0/1)
Clear Ideas - what do you think you will be doing 5 years from now I will be studying because the occupation i want requires a study degree (1) 0 otherwise
Escs – Pisa Index of economic, social and cultural status
mean_escs – Mean for school of Pisa Index of economic, social and cultural status
Misced - Mother's education
Fisced - Father's education
Cultposs – Index Cultural Possession of the family
Joyread - The index of enjoyment of reading activities
Joyreadp - The index of enjoyment of reading activities of parents
Eudmonia -index of meaning in life
Dirins - The index of teacher-directed instruction
Perfeed - The index of teacher feedback
Lmins - Learning time reading minute
Teachint -index of teacher enthusiasm
Teachsup - The index of teacher support

Table 1 – *continued.*

AbleDiffTest- Agree: I am able to understand difficult test. Agree = 1; Disagree =0
NoDiffTest - I have always had difficulty with reading Agree = 0; Disagree =1
ParentHomework- how often: Help my child with his/her reading and writing homework (Never or hardly ever= 0; Once or twice a year= 0; Once or twice a month= 0; Once or twice a week= 1; Every day or almost every day= 1)
Videogames - Agree: I like to meet friends and play computer and video games with them; Disagree = 0 Agree = 1
UsePCHome - using computers at home (dummy 0/1)
Internet - Available for you to use at home: Internet connection Yes and I use it(1) – yes but I don't use it (0)|No (0)
100Pages- how many pages was the longest piece of text you had to read this year for reading lessons? more than 100 = 1; less than 100 = 0

5 Results

Estimates indicate that the gender gap in reading test in Italy averages around 22 points (Tab. 2). Gender difference associated with observable characteristics contributes to explain female positive performance (around 28 points). The observed characteristics contribute to increasing the gender gap in favor of girl, while the gap's unexplainable portion is insignificant as a whole.

Table 2 – *Oaxaca Blinder decomposition.*

	Reading score
Group_1 (F)	511.4690***
	[3.3141]
group_2 (M)	489.5794***
	[3.9109]
Difference	21.8895***
	[3.6880]
Explained	27.6850***
	[2.8013]
unexplained	-57.955
	[3.5988]

Source: Authors' elaborations on OECD-PISA 2018.

The variables that contribute to greater reading performance of girls in the explained part are described below.

Parental expectations, emotional support and help from parents with reading homework have a significant role in the increase in the differential between girls and boys (exp_par, emosups, parent_homework).

A better disciplinary climate (variable disclima) in reading lessons perceived by the student (e.g., a silent lesson, less chaotic atmosphere) increases the differential in favor of girls.

Table 3 – *Explained Oaxaca Blinder decomposition.*

Explained	
Individuals characteristics	
try_Job	-0.3571*
	[0.2031]
try_Coll	0.8338**
	[0.3846]
Eudmonia	1.5083***
	[0.3646]
ableDiffTest	1.3894***
	[0.4493]
noDiffTest	1.6788***
	[0.5247]
Joyread	5.9714***
	[1.4941]
clear Ideas	2.2418***
	[0.5979]
Habits	
Videogames	2.5929***
	[0.9759]
Internet	1.2798**
	[0.5500]
usePcHome	-0.6161*
	[0.3161]
Parents	
emosups	1.1511***
	[0.3696]
exp_par	0.9735***
	[0.3657]
parentHomework	2.1665***
	[0.6488]
School context	
mean_escs	3.2669***
	[1.1690]
dirins	0.6980**
	[0.2785]
disclima	1.1363**
	[0.5266]

Source: Authors' elaborations on OECD-PISA 2018.

Explained variables (Tab. 3) show that girls have significant advantages over boys in their enjoyment of reading and in their perception of reading skills (joyread,

abledifftest, nodifftest), while it is interesting to note that the enjoyment of reading index found in parents has no significant effect.

Having a clear meaning in life (index greater meaning in life) also favors girls (eudmonia).

Among the variables relating to teachers, only the perception of receiving very clear instructions and objectives from them during lessons (dirins) is significant, increasing the differential, while the other variables relating to teaching practices previously illustrated do not seem to affect reading performance.

Motivation and engagement aimed at a specific goal in terms of preparation for university (already clear in mind at the age of 15) increase the difference in reading performance in favor of girls, where we assume that girls are more likely to choose paths and jobs not related to mathematical-scientific skills, and therefore are a priori focused more on reading literacy subjects.

Finally, also the quality or socio-economic level of the school environment contributes on average to significantly increase the reading gender gap. On the contrary, the socio-economic level of the family has no effect on the variables

Among the factors that instead play a role in narrowing the gender gap between female and male students, we find scholastic commitment aimed at obtaining a good job a good job (instead of a "good college"), and also to have read during the 'year, in school practice, a text at least 100 pages long (or more) and no shorter.

Although the overall significance is not observed in the inexplicable part, among the variables analyzed, often playing video games with friends (video games) seems to strongly shorten the girl-boy gap (-13 points) as an inexplicable component (Tab.4). The perception of having no difficulty in reading (NodiffTest) also contributes to significantly reducing the coefficient effect (-17 points).

Receiving feedback from the teacher (perfeed) on one's academic performance in the reading lessons increases the unexplained part of the differential.

Table 4 – *Unexplainable factors - Oaxaca Blinder decomposition results.*

Unexplained	
Dirins	-0.9273*
	[0.4696]
Perfeed	0.4623*
	[0.2643]
NoDiffTest	-17.0816**
	[7.7644]
Videogames	-13.3411***
	[3.3170]

Source: Authors' elaborations on OECD-PISA 2018.

6 Conclusions

Despite his social and pedagogical importance, the gender gap in reading has been poorly studied in the literature, and educational outcomes have usually focused on the underachievement of girls.

Our results on the analysis of the reading gender gap in the OCED PISA 2018 assessment, relative to Italy, suggest that observable variables account for most of the gap. The gender gap in reading is mostly attributable to explained component, while the variables related to the discrimination effect are those related to different habits between women and men. In particular, consistent with the literature, it seems that the habit of spending time playing videogames has a lot of relevance in the discrimination effect.

Therefore, the analysis highlights the importance of "joy of reading" and emphasizes the need to encourage boys to read in order to improve in their reading abilities. Joy of reading is important for reading skill (OECD; 2021) and the school is the context in which stimulate this interest. In fact, it emerges that in the classes where the hours spent in reading are more, the gap seems to decrease. We believe that the well-known propensity of boys towards more technical-scientific paths (science, technology, engineering, and mathematics, STEM) leads to underestimate the importance of this competence, which instead constitutes a very important basic skill also in these fields of education. The results highlighted in this study acquire greater relevance in the Italian context where the average scores in reading literacy obtained by Italian students in international reading assessments are significantly below the OECD average. This means that male students in Italy on average have insufficient reading skills to understand texts and information. Reading, decipher information, and communicate is increasingly important in a digital world and it is necessary to deepen the study of the factors that influence the lower involvement and performance in reading, in a society increasingly based on the correct understanding of information.

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SUMMARY

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The present study analyses the main factors behind the differences in test scores on reading literacy in Italy between male and female 15 years old students performing the Oaxaca-Blinder decomposition method (Blinder, 1973) on the data from the OECD PISA 2018 survey, in which reading was the main subject assessed.

In order to estimate the amount of the differential between male and female average wages, we have applied the decomposition of Oaxaca and Blinder (Oaxaca 1973, Blinder 1973). Through this method we distinguish which part is due to differences in characteristics included in model estimations and which part is due to gender "discrimination".

Our results suggest that the gender gap in reading is mostly attributable to explained component, while the variables related to the discrimination effect are those related to different habits between girls and boys.

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