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Exploring INVALSI Math performances among Slovenian, German and Italian Language Schools

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Abstract

Our study examines the Mathematics achievement gaps among students of different language groups occur through data deriving from National Institute for the Evaluation of the Education System (INVALSI).
The attention is focused on students belonging to Slovenian and German minority languages groups compared to Italian students in Friuli-Venezia Giulia and the Autonomous Province of Bolzano.
The guiding research questions are: are there any differences among Italian students and students belonging to minority languages schools? If so, which competences show more evidence? Are there statistically significant factors that influence these differences? Using INVALSI data series through a longitudinal or a cross-sectional analysis, are there the same significant factors?

Parole chiave: Minoranze linguistiche, Prove standardizzate INVALSI, Risultati di matematica, Analisi longitudinale, Analisi cross-section

Keywords: Linguistic minorities, INVALSI standardized tests, Mathematics achievements, Longitudinal analysis, Cross-sectional analysis

Introduction[1]

Italy is characterized by a rich linguistic landscape. In addition to a multitude of dialects (Tuscan, Neapolitan, Sardinian, Sicilian etc.), in some areas there are several linguistic minorities: French in Valle d'Aosta, Slovene in Friuli-Venezia Giulia, German and Ladin in Trentino Alto Adige, Albanian and Croatian in South Italy.

According to the Council of Europe (1992) «"regional or minority languages" means languages that are: i) traditionally used within a given territory of a State by nationals of that State who form a group numerically smaller than the rest of the State's population; and ii) different from the official language(s) of the State».

At international level, the European Charter for Regional and Minority Languages (ECRML) and the Framework Convention for the Protection of National Minorities (FCNM) promote the protection of national minorities' languages spoken in the Member States of the Council of Europe also concerning education (Council of Europe, 1992, 1995).

In this context, it is necessary and useful to examine whether and to what extent achievement gaps among students of different language groups occur.

This essay attempts to analyse, through data deriving from the National Institute for the Evaluation of the Education System (INVALSI), the academic performance of some linguistic minorities in Italy. The attention is focused on students belonging to Slovenian and German minority languages groups compared to Italian students in, respectively, Friuli-Venezia Giulia and the Autonomous Province of Bolzano, specific contexts of our country characterized by a multilingual social reality.

In order to investigate the skills and competences acquired, in Italy, every year, Italian and Mathematics standardized tests are administered to all four grades students (grades 2 and 5 of Primary School, grade 8 of Lower Secondary School and grade 10 of Upper Secondary School). Therefore, our databases refer to the whole students' population for each grade involved.

For a correct comparison, we consider 2016-2017 results in Mathematics of the four grades investigated for Slovenian and Italian schools in Friuli-Venezia Giulia and only of the grade 10 for German and Italian schools in Autonomous Province of Bolzano because Slovenian schools administer a specific test in their mother tongue, while German language students take only Math tests.

The schools analysed are 314 in Friuli-Venezia Giulia (14 Slovenian and 300 Italian) and 59 in Autonomous Province of Bolzano (43 German and 16 Italian).

[1] This study has been presented at the European Conference on Educational Research 2018 (3-8 Sept at Free University Bolzano).

We are interested to know if i) there are any differences among Italian students and students belonging to minority languages schools; ii) if so, which competences concern; iii) if there are, and which, statistically significant factors that influence the differences, and if using INVALSI data series through a longitudinal or a cross-sectional analysis there are the same significant factors.

Methodology

As a preliminary analysis, descriptive statistics are conducted observing the average performances at the Math INVALSI assessment of Italian, Slovenian and German language schools in 2016-2017 school year. The variables considered are[2]:

- gender;
- origin, an index based on the student-father-mother country of birth. We distinguish between natives and first or second generation immigrants[3];
- socio-economic-cultural indicator (ESCS), computed as a synthesis of parent's occupation and educational level plus some families' resources at home;
- language spoken at home, distinguishing between Italian or other language;
- type of school (Lyceums, Technical schools, Vocational schools and Vocational Training schools only for grade 10).

According to the main hypotheses on which this paper is based, performances depend on several aspects.

The first is the individual dimension, including gender, social background and language spoken at home.

Generally, males and females achieve different scores: for instance, males perform higher than females in Financial literacy and Mathematics and *vice versa* in Reading comprehension. These trends are recorded both national and international studies (Glenn and Swanson, 2010; Stoet and Geary, 2013; Contini et al., 2017; Dalla Villa et al., 2017; Ricci, 2017; INVALSI, 2018).

From a large literature (Brunello and Checchi, 2006; Marks et al., 2006; Campodifiori et al., 2010), it emerges that familys' resources are a prominent influencer factor on education. In particular, from the family socio-economic conditions derive inequities (Kieffer, 2010; Sirin, 2005; Meir and Armon–Lotem, 2017). An OECD study conducted to analyse the students with an immigrant background (OECD, 2018) evidences that socio-economic disadvantages, together with language barriers, are the greatest obstacles to the successful integration and educational goals of these students: more in details, this factor explains over one-fifth of the

[2] The information about socio-economic-cultural indicator and language spoken at home are taken from the Student's Questionnaire.
[3] We use the expression 'Foreign of first generation' to indicate that students and their parents were born abroad, while 'Foreign of second generation' that the students were born in Italy, but their parents abroad.

gap between immigrant students and students without immigrant background in obtaining baseline competences levels.

Finally, according to several studies (Martini and Ricci, 2009; Hoff, 2013; Rosa, 2013) lower performances are associated with a higher use of another language spoken at home (different to that one used at school) as a result of possible marked difficulties to passing from one language to another and to understanding linguistic peculiarities.

The second dimension that influences student's performances is the type of school attended (regard only the Upper Secondary School). As highlighted every year by INVALSI national Report (INVALSI, 2018), in Italy there are differences between students who attend different types of schools: for example, basically, Lyceum students are characterized by better performances compared to the others.

Finally, the third and last dimension studied is about test's characteristics. INVALSI test items are grouped by arguments ('Statistics', 'Numbers', 'Shapes and figures', 'Relationships and functions') and by cognitive process[4] involved ('Problem solving', 'Knowing' and 'Arguing'). The attention on these dimensions is justified by evidences that confirm a connection between some of these aspects and a good command of linguistic competences.

An analysis of variance (ANOVA) is carried on to confirm that the statistically significant mean differences on test scores are associated with group membership (Tabachnick and Fidell, 2013; de Smith, 2015): Italian language schools' students or minority language schools' students.

The following step is to observe if the emerged evidences are confirmed using data of the previous assessments (from 2014-2015 to 2015-2016), through a cross-sectional design. That is, we provide, for each school year, a data time series of differences between school test scores and the respective annual benchmark, based on the fact that INVALSI tests are not directly comparable across years (at least until last school year 2016-2017).

Finally, another step has a longitudinal design which allows us to carry on an analysis on the same cohort of students (the 2016-2017 cohort), matching their test scores obtained at the INVALSI standardized tests administered in their previous career (Xian, 2015). This has been possible by using the SIDI code which identify uniquely each student along his career: in our study this code can be used to associate grade 10 test scores in 2016-2017 to grade 8 test scores in 2014-2015.

In details, our aims are reached by: i) analysis of variance, considering test scores as dependent variable and gender, origin, language spoken at home and type of school as independent variables, ii) regression, conducted using test scores and socio-economic-cultural index, iii) difference in percentage scores by arguments and

[4] Mathematics test is organized on two dimensions: content dimension (arguments), regarding several mathematical fields to which the questions refer; cognitive dimension (cognitive process), regarding the process activated by students to solve questions.

cognitive processes in Slovenian, German and Italian schools and iv) differences from the national average for the comparison between performances detected at different times.

The following table (Table 1) records the number of students on which the analyses are conducted, distinguishing by school year (2014-2015, 2015-2016 and 2016-2017), grade (2, 5, 8 and 10) and different language schools[5].

Table 1 – Number of analysis cases

	Grade 2		Grade 5		Grade 8		Grade 10			
School Years	**IT-FVG**	**SLO-FVG**	**IT-FVG**	**SLO-FVG**	**IT-FVG**	**SLO-FVG**	**IT-FVG**	**SLO-FVG**	**IB**	**GB**
2014-2015	9,440	271	8,729	262	9,363	253	6,686	124	1,089	3,572
2015-2016	8,907	289	6,761	177	9,388	231	4,657	78	754	2,170
2016-2017	8,590	284	8,848	282	9,250	245	7,945	135	939	3,395

Source: INVALSI

Analysis results

Cross-sectional analysis

First part of our analysis is carried out comparing three school years (2014-2015, 2015-2016 and 2016-2017) from a cross-sectional point of view. In this case, students analyzed in each year aren't the same and the main aim is to observe if there are some changes or stability among linguistic minority schools compared to Italian ones.

Considering data by belonging to a language minority school than Italian school[5], we observe that in some cases Slovenian and German school are characterized by better performances when we compare with national averages (in the last row) (Table 2); while, focusing the attention on the respective regional averages this situation occurs in 2014-2015 for grade 10, both Slovenian (223.7 versus 219.0) and German schools (212.0 versus 207.3) and in 2015-2016 for German school of grade 10 (213.2 versus 205.3).

[5] IT-FVG: Italian schools in Friuli-Venezia Giulia; SLO-FVG: Slovenian schools in Friuli-Venezia Giulia; IB: Italian schools in Autonomous Province of Bolzano; GB: German schools in Autonomous Province of Bolzano.

Table 2 – Average scores in Mathematics test by school and grade

	2014-2015				2015-2016				2016-2017			
	G2	G5	G8	G10	G2	G5	G8	G10	G2	G5	G8	G10
IT-FVG	**209.4**	**212.0**	210.0	**219.0**	**210.2**	**208.6**	**207.0**	**218.1**	211.4	**211.4**	210.0	**218.2**
SLO-FVG	**203.4**	**200.3**	207.5	**223.7**	**222.8**	**217.3**	**201.3**	**211.9**	212.8	**196.2**	207.5	**215.3**
IB	-	-	-	**207.3**	-	-	-	**205.3**	-	-	-	**209.3**
GB	-	-	-	**212.0**	-	-	-	**213.2**	-	-	-	**204.3**
National Mean	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0	200.0

In bold values with $p < 0.05$. Source: INVALSI

Moving on to a more in-depth analysis, according to literature, in general, for every years and grades, we note that males achieve scores higher than females (Table 3), except in some cases in Slovenian schools for grades 2 (in 2014-2015 and 2016-2017) while in grades 8 and 10 the differences are more similar to Italian schools. The principal evidence is about the increase of this gap which goes up by Upper Secondary school. In fact, we observe that for grade 2 the differences are around 4-5 points, they increase for grade 5 and 8, especially in the last year, and for grade 10 they become more significant.

For grade 10 there are two principal evidences: first, generally, the gap male/female exceeds 10 points and second, in German schools in the last years analyzed the gender gap is strongly lower than others (3.2 while in 2014-2015 and 2015-2016 is, respectively, 14.9 and 11.9).

Basically, native students of Italian schools achieve average scores higher than foreigners students, especially foreigners of first generation (Table 4). This trend also occurs in German schools, but if we compare average scores of Italian and German schools it emerges that, in 2015-2016, in the latter these are generally higher than the first ones.

Moreover, in Slovenian school second generation performances are even better than natives: for example, for grade 2 in the last two years (227.3 versus 222.4 and 231.8 versus 211.5), for grade 5 in 2014-2015 (212.6 compared to 199.6) and 2015-2016 (220.8 versus 217.4) and for grade 8 in every school years.

Considering German school, instead, the second generation performances are similar to those in Italian schools.

Table 3 – Average scores in Mathematics test by school, grade and gender

2014-2015												
	Grade 2			Grade 5			Grade 8			Grade 10		
	M	F	M-F	M	F	M-F	M	F	M-F	M	F	M-F
IT-FVG	**211.5**	**207.1**	4.4	**215.9**	**207.9**	8.0	**212.7**	**207.0**	5.7	**226.9**	**211.1**	15.8
SLO-FVG	201.4	205.2	-3.8	200.3	200.3	0.0	209.6	205.7	3.9	**232.1**	**216.5**	15.6
IB	-	-	-	-	-	-	-	-	-	**215.1**	**198.5**	16.6
GB	-	-	-	-	-	-	-	-	-	**220.0**	**205.1**	14.9
2015-2016												
	Grade 2			Grade 5			Grade 8			Grade 10		
	M	F	M-F	M	F	M-F	M	F	M-F	M	F	M-F
IT-FVG	**212.6**	**207.7**	4.9	**211.7**	**205.3**	6.4	**209.3**	**204.5**	4.8	**225.3**	**211.2**	14.1
SLO-FVG	222.8	222.8	0.0	220.0	215	5.0	204.0	198.5	5.5	**223.5**	**199.6**	23.9
IB	-	-	-	-	-	-	-	-	-	**209.8**	**199.8**	10.0
GB	-	-	-	-	-	-	-	-	-	**219.7**	**207.8**	11.9
2016-2017												
	Grade 2			Grade 5			Grade 8			Grade 10		
	M	F	M-F	M	F	M-F	M	F	M-F	M	F	M-F
IT-FVG	**213.6**	**209.2**	4.4	**215.6**	**207.1**	8.5	**214.6**	**205.3**	9.3	**223.7**	**212.4**	11.3
SLO-FVG	210.7	215.2	-4.5	197.1	195.3	1.8	213.7	205.8	7.9	218.7	212.7	6.0
IB	-	-	-	-	-	-	-	-	-	**217.3**	**202.7**	14.6
GB	-	-	-	-	-	-	-	-	-	**206.0**	**202.8**	3.2

In bold values with $p < 0.05$. Source: INVALSI

Table 4 – Average scores in Mathematics test by school, grade and origin

2014-2015												
	Grade 2			Grade 5			Grade 8			Grade 10		
	It.	I Gen.	II Gen.	It.	I Gen.	II Gen.	It.	I Gen.	II Gen.	It.	I Gen.	II Gen.
IT-FVG	**212.7**	**190.0**	**192.9**	**214.3**	**190.6**	**198.6**	**213.0**	**184.7**	**192.6**	**221.2**	**197.3**	**206.3**
SLO-FVG	204.7	159.7	191.2	199.6	187.1	212.6	207.8	198.9	208.5	225.4	165.5	203.6
IB	-	-	-	-	-	-	-	-	-	**210.8**	**189.0**	**203.4**
GB	-	-	-	-	-	-	-	-	-	213.1	186.5	200.6
2015-2016												
	Grade 2			Grade 5			Grade 8			Grade 10		
	It.	I Gen.	II Gen.	It.	I Gen.	II Gen.	It.	I Gen.	II Gen.	It.	I Gen.	II Gen.
IT-FVG	**213.4**	**192.7**	**193.4**	**211.6**	**189.7**	**192.4**	**209.6**	**184.7**	**192.6**	**220.2**	**199.6**	**206.6**
SLO-FVG	222.4	236.5	227.3	217.9	200.5	220.8	201.9	187.2	203.6	213.7	198.0	198.0
IB	-	-	-	-	-	-	-	-	-	**209.3**	**186.9**	**199.7**
GB	-	-	-	-	-	-	-	-	-	214.0	195.5	205.7
2016-2017												
	Grade 2			Grade 5			Grade 8			Grade 10		
	Nat.	I Gen.	II Gen.	Nat.	I Gen.	II Gen.	Nat.	I Gen.	II Gen.	Nat.	I Gen.	II Gen.
IT-FVG	**214.5**	**197.0**	**195.0**	**213.7**	**192.4**	**198.6**	**212.5**	**184.7**	**196.1**	**220.5**	**194.8**	**205.8**
SLO-FVG	211.5	214.0	231.8	196.4	182.5	198.6	208.3	214.8	225.0	216.7	155.5	209.6
IB	-	-	-	-	-	-	-	-	-	**212.4**	**193.3**	**203.3**
GB	-	-	-	-	-	-	-	-	-	205.0	195.6	196.6

In bold values with $p < 0.05$. Source: INVALSI

About the socio-economic-cultural indicator[6] we expected, according to other studies specified in the previous paragraph, that students from families with more resources get better results. This hypothesis is confirmed also in our case (Table 5), but we note that in linguistic minority schools the background effect is lower than Italian schools.

Generally, beta values in Italian school go from 0.21 to 0.26 while in Slovenian and German schools from 0.12 to 0.19.

Table 5 – Average scores in Mathematics test by school, grade and socio-economic-cultural indicator (ESCS)

		2014-2015			2015-2016			2016-2017		
		B	beta	R^2adj	B	beta	R^2adj	B	beta	R^2adj
Grade 5	IT-FVG	**11,100**	**0,25**	**0,061**	**11,6**	**0,26**	0,065	**11,04**	**0,26**	0,069
	SLO-FVG	**6,375**	**0,14**	**0,015**	**7,812**	**0,16**	0,021	**5,616**	**0,13**	0,012
Grade 10	IT-FVG	**10,19**	**0,23**	**0,054**	**10,1**	**0,23**	0,052	**9,969**	**0,23**	0,054
	SLO-FVG	**11,27**	**0,18**	**0,024**	3,861	0,118	0,001	**7,222**	**0,2**	0,031
	IB	8,385	0,210	0,043	**10,839**	**0,257**	0,065	**7,866**	**0,21**	0,042
	GB	**8,592**	**0,22**	0,048	**7,349**	**0,17**	0,030	**3,505**	**0,13**	0,016

In bold values with $p < 0.05$. Source: INVALSI

According to our hypotheses, the language spoken at home influences the results. In Italian schools students who speak Italian are advantaged compared to the students those who speak a different language. In particular, in 2014-2015 and 2016-2017 the differences in average scores exceed 10 points in Italian schools both in Autonomous Province of Bolzano.

In contrast, in schools of Autonomous Province of Bolzano, the average scores for students who speak a different language from Italian are higher than the others in the last two years (respectively, 216.4 compared to 212.9 in 2015-2016 and 204.6 compared to 199.8 in 2016-2017).

Students speaking a language other than Slovenian, German and Italian are about half in Slovenian schools[7] of grade 5 while in grade 10 these percentage decreases even if it's higher than others. Instead considering the Autonomous Province of Bolzano between Italian and German schools the percentage differences are less evident (around 5-6 points).

[6] The information about socio-economic-cultural index is recorded only for grades 5 and 10.
[7] Mostly Albanian language.

Table 6 – Average scores in Mathematics test by school, grade and language spoken at home

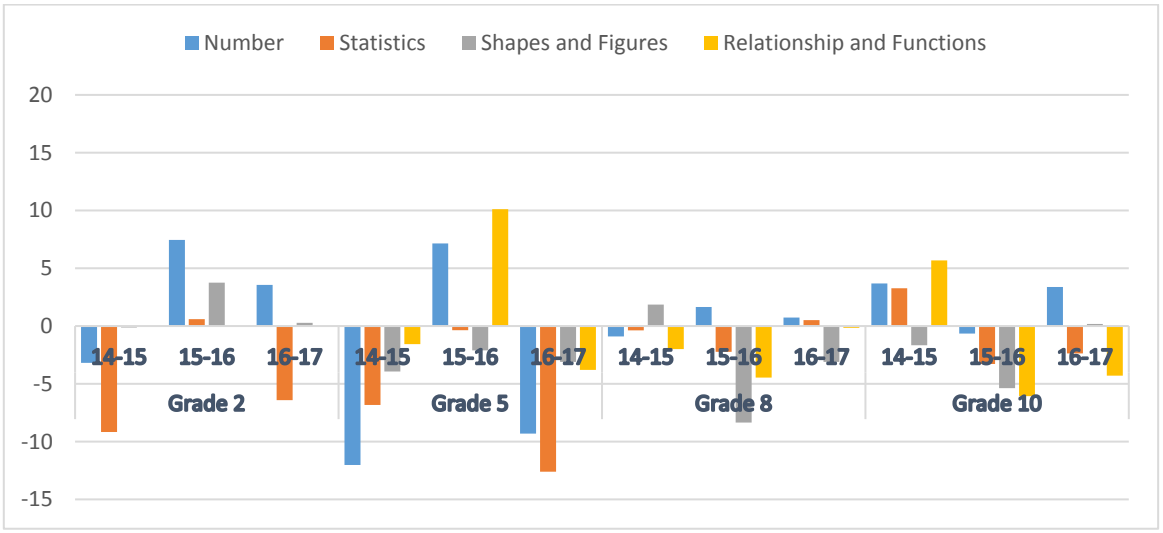
		2014-2015		
		Italian	Other	I-O
Grade 5	IT-FVG	**214.3**	**199.1**	15.2
	SLO-FVG	202.1	198.5	3.6
Grade 10	IT-FVG	**220.6**	**206.3**	14.3
	SLO-FVG	225.6	218.2	7.4
	IB	**209.7**	**196.1**	13.6
	GB	**212.8**	**204.4**	8.4
		2015-2016		
		Italian	Other	I-O
Grade 5	IT-FVG	**209.2**	**205.7**	3.5
	SLO-FVG	216.8	217.8	-1.0
Grade 10	IT-FVG	**218.8**	**212.2**	6.6
	SLO-FVG	**216.4**	**201.0**	15.4
	IB	206.0	202.0	4.0
	GB	212.9	216.4	-3.5
		2016-2017		
		Italian	Other	I-O
Grade 5	IT-FVG	**213.6**	**198.2**	15.4
	SLO-FVG	**200.8**	**191.7**	9.1
Grade 10	IT-FVG	**220.8**	**201.3**	19.5
	SLO-FVG	216.2	213.4	2.8
	IB	**211.5**	**200.4**	11.1
	GB	**199.8**	**204.6**	-4.8

In bold values with $p < 0.05$. Source: INVALSI

Distinguishing the results by arguments of Math tests (Figure 1 and 2), we can affirm that the lower general performances of Slovenian schools detected in Table 1 are strongly inhomogeneous: they're much lower for 'Statistics' in grade 2, for 'Statistics' and 'Numbers' in grade 5, while in grade 8 and 10 the stronger gaps are for 'Shapes and Figures' and 'Relationship and Functions' (most of all in 2015-2016), as shown in Figure 1. We can at least in part explain that gap in grade 8 with a lack of 'Arguing' cognitive process (-13 percentage points in 2015-2016), as shown in Figure 3.

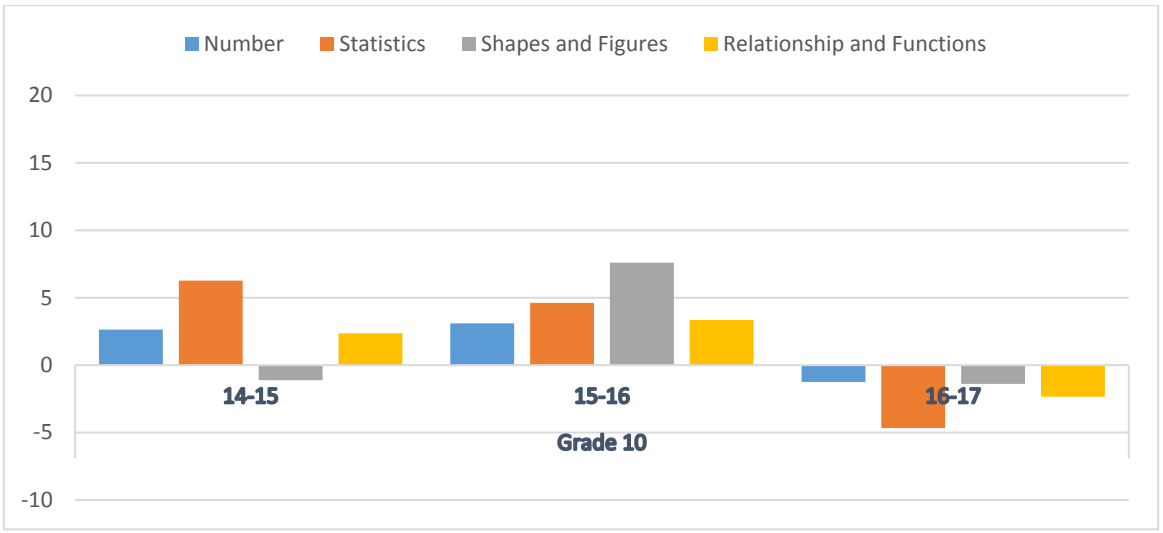
The same cannot be affirmed for German schools: the differences between their results and the ones of Italian schools are rather equally spread around the four arguments of the Math test, as shown in Figure 2.

Figure 1 – Differences between Slovenian and Italian schools for Arguments and grade



Source: INVALSI

Figure 2 – Differences between German and Italian schools for Arguments and grade

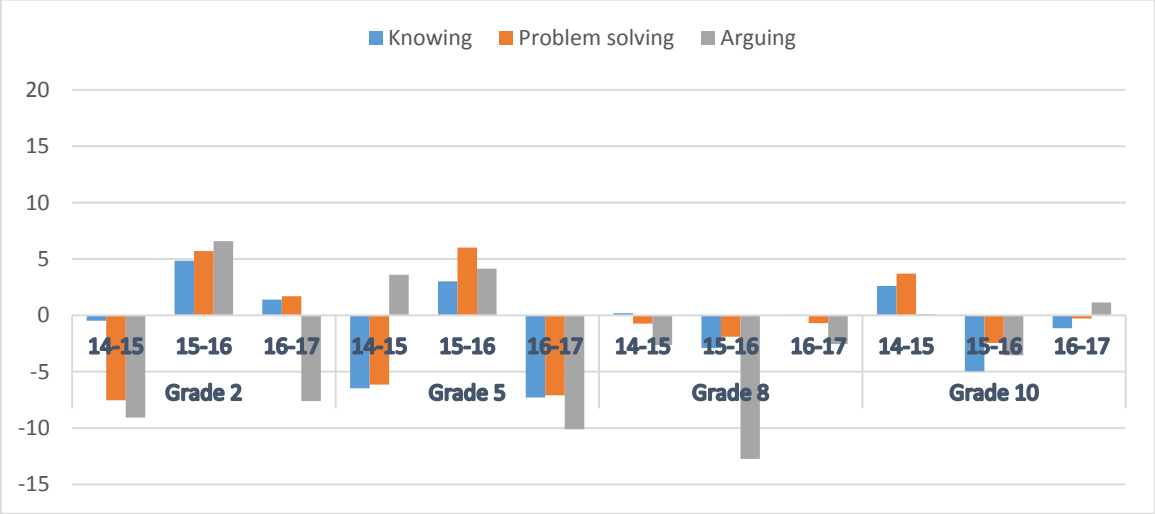


Source: INVALSI

Observing the results by cognitive processes activated by students to solve questions (Figure 3 and 4), we note that in Slovenian schools performances are lower for 'Arguing' process, especially in 2014-2015 and in 2016-2017 for grade 2, 5 and 8.

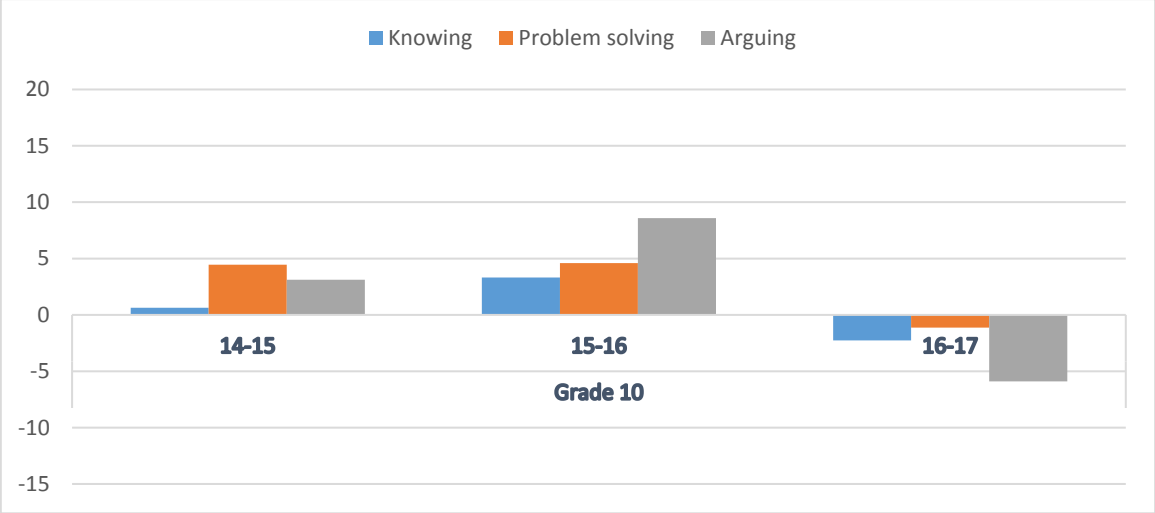
If we focus the attention on differences in Autonomous Province of Bolzano, it's interesting that, generally, in the first two years studied (2014-2015 and 2015-2016) the results are better in Italian schools, whereas in the last year this happens only in German ones. Moreover, except in 2014-2015, as well as Slovenian-Italian schools, 'Arguing' is the cognitive process that record higher percentage differences but in 2015-2016 German schools perform lower than Italian and in 2016-2017 *vice versa*.

Figure 3 – Differences between Slovenian and Italian schools for Cognitive processes and grade



Source: INVALSI

Figure 4 – Differences between German and Italian schools for Cognitive processes and grade



Source: INVALSI

Regarding grade 10 we have deepened the analysis by type of school (Table 7), finding out some interesting notice. On one side Lyceums perform better than other schools both in Slovenian and Italian schools in Friuli-Venezia Giulia region, as we expected; on the other side, while this is confirmed also for Italian schools in Bolzano, we highlight an opposite situation for German schools: Technical schools present similar or even better results than Lyceums, for all the three school years considered.

Table 7 – Average scores in Mathematics test by school, grade and type of school

	2014-2015			
	IT-FVG	SLO-FVG	IB	GB
Vocational Training School	**184.4**	-	**176.7**	**189.7**
Lyceum	**228.4**	**227.5**	**218.7**	**220.4**
Technical School	**221.7**	**222.9**	**213.4**	**223.2**
Vocational School	**180.9**	**175.6**	**188.4**	-
	2015-2016			
	IT-FVG	SLO-FVG	IB	GB
Vocational Training School	**165.6**	-	**173.5**	**192.**
Lyceum	**225.5**	212.0	**221.5**	**222.1**
Technical School	**220.4**	211.7	**202.3**	**219.0**
Vocational School	**181.7**	-	**175.5**	-
	2016-2017			
	IT-FVG	SLO-FVG	IB	GB
Vocational Training School	**168.0**	-	-	**193.3**
Lyceum	**230.6**	**220.0**	**217.5**	**208.2**
Technical School	**217.4**	**207.2**	**201.6**	**210.5**
Vocational School	**181.2**	-	**178.0**	-

In bold values with $p < 0.05$. Source: INVALSI

Longitudinal analysis

The second part of our study is carried on in a longitudinal approach, analyzing the results obtained by the same students in different years: so, in this case the interest is about improvement or worsening in Math test from grade 8 to grade 10. In fact, one of the features of INVALSI data to be exploited more and more over next years is the possibility to link students between achievement tests taken at different school grades. That is, we can match databases referred to different school years using the univocal 'SIDI' code as a key. In our case we match Math performances of students from grade 8 in 2014-2015 with grade 10 in 2016-2017, referring only to Friuli-Venezia Giulia region. We couldn't use German language students because there're no data for 2014-2015. There are some limits using this method: a) some matches could not work due to some SIDI codes missing or wrong; b) some students could be missing in the 2016-2017 database because rejected in grade 8 or 9 or absents the day of the test (or, in a very minimal quota, moved to a school in another region after grade 8).

For the Friuli-Venezia Giulia region, we dispose of 9,621 students tested in grade 8 2014-2015 (the test was mandatory) and of 8,617 students tested in grade 10: considering the obstacles described above we were able to link 6,622 units between the two databases, that is 69% of the 8 grade available data, or the 77% of the 10 grade available data.

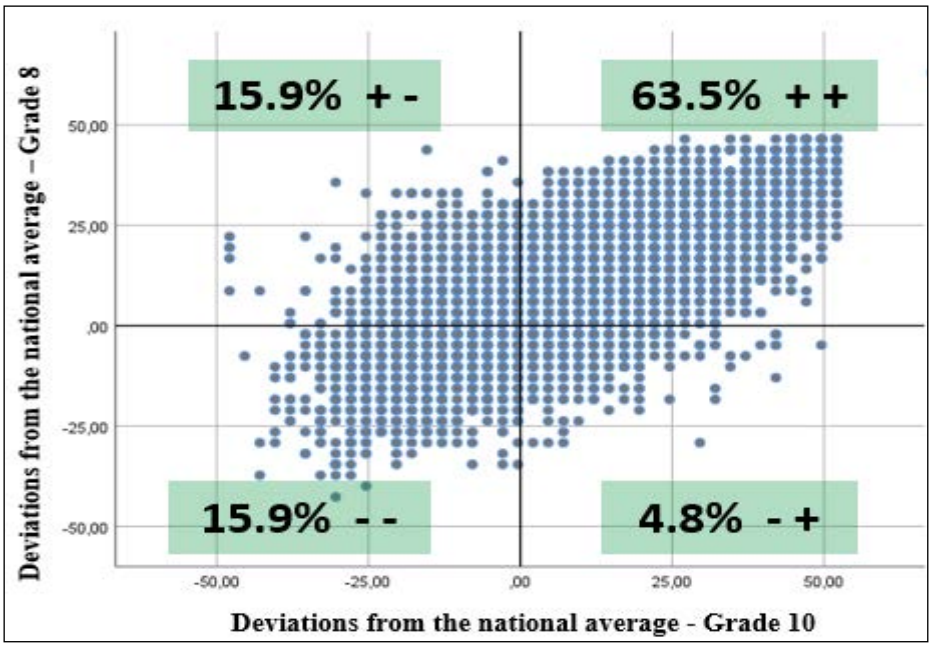
Using this 'linked students' database we calculate, for each student and for both grade 8 and 10, the difference between the test performance and the national average. In other words, we're considering differences from the average, obtaining numbers above/below zero if the performance is above/below the national average.

The longitudinal approach revealed some interesting results (Figure 5 and 6).

The first one concerns the continuation of studies in the same type of school (Italian or Slovenian): while all grade 8 Italian language students in Friuli continue their studies in an Italian language school in G10 (100% of 6,422), this does not happen for Slovenian language students; after two years 74% of them are in a Slovenian language high school, while 26% in an Italian language one.

The second evidence regards the performances: we can plot in a diagram the differences form the national average, grade 8 on the vertical axis and grade 10 on the horizontal axis (Figure 5 and 6), in order to detect those students which improve their performances, passing from a negative deviation to a positive.

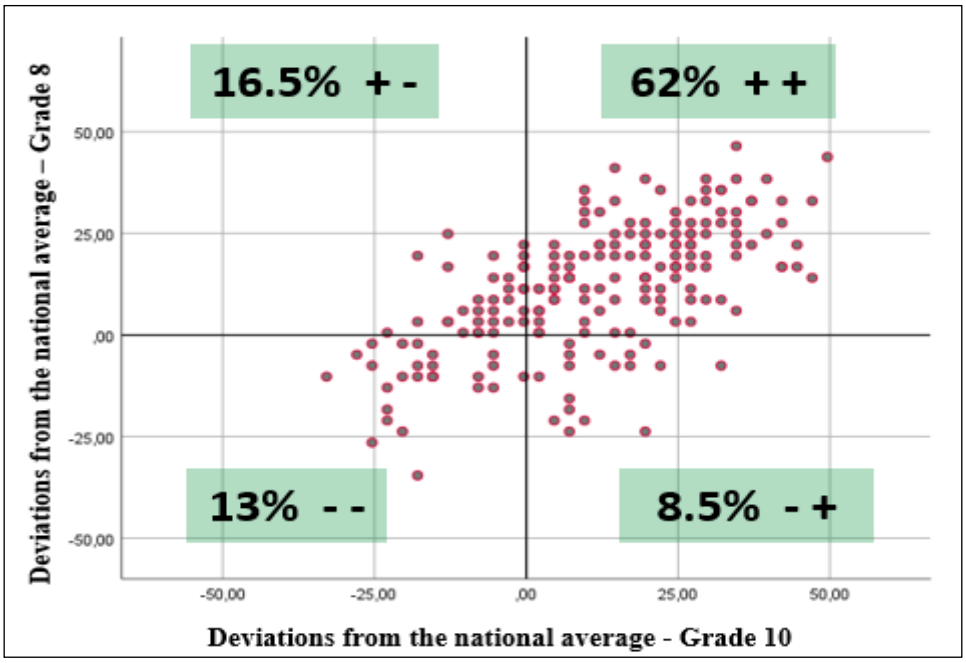
Figure 5 – Mathematics performance in Italian schools from grade 8 to grade 10



Source: INVALSI

We observe an improvement in INVALSI test scores higher for Slovenian than for Italian language students: 8.5% of students in Slovenian schools in grade 8 in 2014-2015 which performed below the national average obtain a performance over the same average in grade 10 in 2016-2017 (Figure 6), compared to only 4.8% of their Italian language colleagues.

Figure 6 – Mathematics performance in Slovenian schools from grade 8 to grade 10



Source: INVALSI

Concluding comment

Based on the guiding research questions, the data analysis shows that it's crucial which comparison we carry on because there are differences between Italian schools and linguistic minorities performances.

We observe two main trends: the first is that mathematics results in Slovenian schools are similar or higher than national average, but lower than regional (compared to Italian schools); the second trends regards mathematics results in German schools and, in particular, these are higher than national averages, but less high if compared to the rest of Autonomous Province of Bolzano and lower for the last school year considerate.

Other relevant aspect that emerges from our analysis regards that there are some evidences of more 'equity' in minority language schools for mathematics performances and that we could summarize as follows: i) in Slovenian schools for the two Primary school grades the gender gap is less pronounced compared to German and, mostly, Italian school; ii) always in Slovenian schools in grades 2, 5 and 8 foreign students of second generation perform equal or even better than their similar; iii) in Slovenian school, in all grades and years, and in German school in last two years socio-economic-cultural conditions impact less on the students' performances; iv) both in Slovenian and German schools there is less gap between students who speak a different language at home; v) in German schools mathematics results show more 'equity' if we compare the scores achieve in the several type of school. In fact, Technician schools perform same of Lyceum and the results by type of schools are less spread than Italian schools; vi) from a longitudinal point of view, in Slovenian school the percentage of students that improve are higher compared to Italian school.

In conclusion, this paper has contributed to highlight some aspects concerning the learning of two linguistic minorities, Slovenian and German, a phenomenon of fundamental importance in a context such as the Italian one, but still too little investigated.

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