Inequalities in Skills at the End of Education

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Abstract – School-based skills assessments, such as those conducted with PISA, are well established and show significant differences between students depending on their parents' occupation, geographical origin and gender, at the end of primary school or at the end of secondary school. This article, using surveys that include an assessment of skills among young adults aged 18 to 29 years (IVQ and PIAAC), looks at these inequalities at a less commonly studied time: the end of education. These young people have higher skills than older people, but with high variability, especially depending on the qualification. Their skills are linked to their social background, gender and geographical origin and partly, but only partly, to long-known educational inequalities. At the end of education, the inequalities in skills observed in France are on the same scale as those observed in other OECD countries; in France and elsewhere, they are close to what is observed at age 15.

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The inequalities in education can be studied from different angles, in particular that of the educational pathway (education tracks and study options, achieving a qualification, etc.) or of the acquisition of skills (in French and in maths, for example), these scopes being partly linked. This article looks at inequalities at the end of education, in particular with an analysis in terms of skills, which has rarely been conducted at this point of education.[1]

Indeed, for a long time, the study of the educational pathway and the qualifications achieved has been prioritised in the analysis of inequalities in education. The interest in this perspective is probably due to the fact that, in line with Bourdieu's analyses, the differences in educational pathway according to the parents' profession allow the analysis of the reproduction of social classes from one generation to another. Thus, work on educational inequality often fits into the perspective of social mobility (Goux & Maurin, 1997a; Vallet, 1999; more recently, Godin & Hindriks, 2018).

From a school-based perspective, work based on the French survey *Formation et Qualification Professionnelle* (FQP, a survey on training and vocational qualification) or the Labour Force Survey has allowed to describe the evolution of inequality of access to qualifications during the 20[th] century. These studies all highlight the significant extension of education for all students, often referred to as "quantitative democratisation", but differ on the evolution of social inequalities, or "qualitative democratisation". For some (Goux & Maurin, 1995; 1997b), the democratisation of education has been uniform: all social groups have equally benefited from the extension of education, keeping social inequalities at the same level. Others point to a slight reduction in educational inequalities, depending on the parents' profession (Thélot & Vallet, 2000; Albouy & Tavan, 2007). However, this improvement has also been discussed with the widening of access to the baccalaureate (equiv. A-levels) and higher education: social inequalities would have simply shifted from one level of education to the next (Duru-Bellat & Kieffer, 2000). Moreover, at a given level of education, the differences in social recruitment are very clear across sectors, for example, between baccalaureate courses or between higher education tracks and do not seem to have been mitigated, leading Merle (2000) to refer to "segregative democratisation".

Studying the skills and knowledge of students directly makes it possible to partly break away from the effects of the development of the education system in terms of training offer. Indeed, increasingly, research in this area is based on this type of data: the OECD's PISA (Programme for International Student Assessment) survey has become a key benchmark for assessing education systems at the end of compulsory schooling. Since 2003, the Cedre Survey (aimed at the evaluation of pupils' skills) by the DEPP (the statistical directorate of the French Ministry of Education) has provided indicators on the mastery of school curricula, in mathematics and reading, but also in foreign languages, history, geography and science, at the end of primary school and at the end of secondary school. This interest in skills is justified by the desire to measure more directly whether the school's objectives are met, but also by the search for a more precise picture of "human capital" (Hanushek *et al.*, 2015). These surveys generally provide indicators of the effectiveness of education systems (in terms of student success), but also of their degree of equity, particularly in different social environments. For example, PISA highlighted France's average performance position, but above all a very high level of social inequality.

According to the PISA survey, France is indeed one of the countries where the difference in skill scores between students from highly disadvantaged and highly advantaged backgrounds is greatest, after an increase in social inequality in France occurring in the 2000s. In 2000, in reading comprehension, France was slightly above the OECD average in terms of social inequality: one unit of variation in the Economic, Social and Cultural Status Index (ESCS)[2] was associated with a 44-point increase in reading performance compared with 39 for the OECD as a whole (with a standard deviation of 100); 9 years later, the effect of the social background increased to 51 points in France compared with 38 points in all OECD countries (Fumel *et al.*, 2010). The development was even more marked for mathematics skills (Keskpaik & Salles, 2013): in 2003, one unit of variation in the ESCS index was associated with a score increase of 43 points compared with 39 points in the OECD as a whole; in 2012, the increase in score linked to one unit of variation in the ESCS index increased

1. Another article (Murat, forthcoming), also relating to young adults' skills at the end of their education and using the same sources, addresses the question of the average level and the gross distribution of the results.
2. This index, constructed by the OECD from the students' responses to the survey's biographical questionnaire, combines information on the profession and educational level of parents, with information on educational or cultural items available at home and various goods related to the standard of living (dishwasher, car, etc.).

to 57 points in France and remained stable in the OECD as a whole. Regarding the reading comprehension score, 28.1% of the variance in 2009 is explained by student characteristics in France, compared with 22.1% in the OECD as a whole (OECD, 2011). For the mathematics score, the share of variance explained by the detailed characteristics of students was 29.9% in 2012, compared with 21.0% in all OECD countries (OECD, 2013). The latest PISA results showed a stable inequality between the late 2010s and today (Chabanon *et al.*, 2019). The same level of correlation (about 30% variance in performance explained by student characteristics) was observed at the end of lower secondary school (equiv. 9th Grade), on a panel of students starting secondary school in 2007 monitored by the DEPP, with skill assessments in various fields and a very precise description of the family environment (Ben Ali & Vour'h, 2015).

However, at age 15 or at the end of secondary school, pupils are still far from having completed their studies and can take very different paths in secondary and higher education depending on their social environment. Unfortunately, there is almost no statistical operation of skills assessment after the end of secondary school, in France in any case (except for a reading assessment during the Defence and Citizenship days attended by all 17-year-olds of French nationality, but no information on the social background is collected). We will attempt to work around this issue by using surveys that include an adult skills assessment. This type of survey as yet has a short history: since the mid-1990s, the OECD has conducted a cycle of three operations: International Adult Literacy Survey (IALS), Adult Literacy and Lifeskills Survey (ALSS) and Program for the International Assessment of Adult Skills (PIAAC). In the 2000s, France organised its own survey – *Information et vie quotidienne* (IVQ) – in 2004 and 2011; the work presented here is primarily based on this survey.

This IVQ survey included exercises in reading comprehension, calculation and oral comprehension.[3] It represents a sample of approximately 4,400 people aged 18 to 29, of whom 1,100 are still in education, 1,500 having finished less than five years before the date of survey, and 1,800 five years before or more. Complementary results from PIAAC will also be presented, with a smaller sample for France (1,700 people aged 16 to 29 years), but an interesting international comparison perspective.[4]

In a first section, we will define the framework for this study, specifying what we mean by inequalities in skills and level of education and the methodology to measure them. The second section, using IVQ, will seek to quantify and describe skills inequalities among young people who have just completed their studies. It will firstly show the strong link between skills and level of education. The skills and then the level of education will then be compared with the characteristics of the young people (social environment, gender, geographical origin, etc.). After the study of Place & Vincent (2009), it will then be possible to link these two traditions of statistical analyses of social inequality in education: study of the highest qualification achieved (necessarily for people who have completed their education) and study of skills (rarely carried out beyond secondary school).[5] Despite a clear convergence, consistent with the strong correlation between these two indicators of educational achievement, the inequalities are not identical. In a final section, we will study the temporal development of skills inequalities, comparing IVQ 2004 and IVQ 2011 and mobilising PIAAC to confirm the results and provide an international perspective.

1. Measure of the Inequalities in Skills and Education Level

1.1. What Are Educational Inequalities?

Statistical analysis of the education system has long been based on indicators relating to the educational pathway (qualifications achieved, study tracks and options, repeating years). However, with the opening up of education to the wider population, the sharp rise in educational attainment throughout the 20th century has raised questions, often worrying ones, about the value of qualifications and, indeed, more generally, about student skills, as pointed out by Thélot (1992) or Baudelot & Establet (1989). This is why more and more surveys are being conducted on students' skills.

For several reasons, the skills gaps do not correspond to the educational gaps. On the one hand, at a given level of education, a wide variation

3. This survey is presented in Vallet (2015). Further references to adult competencies assessments and a more detailed description of IVQ exercises are provided in Murat (forthcoming).
4. PIAAC measures "literacy" and "numeracy" with a different protocol from IVQ, but a careful comparison shows a strong convergence of results between the two surveys, particularly in terms of correlation with age, gender and qualification (Jonas et al.*, 2013).*
5. Compared to the work of Place & Vincent (2009), this article has the advantage of having more data (IVQ 2011 and PIAAC 2012); it also puts a greater emphasis on young people, and adopts a different methodological approach regarding the measurement of educational attainment.

in skills is generally observed (two individuals with the same qualification do not have exactly the same level of skills). On the other hand, the skills assessed also do not make it possible to predict the highest level of education achieved. In fact, in addition to possible errors in the measurement of skills that can mitigate the relationship, the level of education also depends on other factors: non-observed skills, particular tastes, different expectations for different families, etc. There are therefore differences in skills at a given level of education, and differences in educational level with fixed skills, which can be linked to individuals' characteristics.

The link between inequalities in skills and education was examined very early in empirical work. The longitudinal perspective is essential here, making it possible to compare the educational pathway (study tracks and options or final level of education) with the initial level of skills, or to study the development of skills according to the choice of study track. The first panel of students followed from the start of secondary school was set up by Ined (the French National institute of demography) in the early 1960s. It showed that the social inequalities in early study tracks could not be explained entirely by skill gaps (Girard & Bastide, 1963). The next panels, led by the statistical services of the Ministry of National Education, have allowed for refinement and monitoring of the development of social inequalities in secondary school and also in primary school (see Caille, 2017 for a review of how they have been used). The work of IREDU highlighted, in the 1990s, the increase in social inequalities in skills over the course of lower secondary school (Duru-Bellat *et al.*, 1993).

In this article, we will take a broad approach to educational inequalities, not limited to "social" inequalities, i.e. inequalities depending on social background and in particular parents' profession. However, these social inequalities remain the dominant factor in theoretical analyses and empirical results. The first studies, extending, as mentioned, the analyses on social mobility, have focused on the parents' profession (the father's in particular). This angle of analysis remains very frequent, probably because it is information that is fairly easy to acquire (even by the students), and is found in the information systems of the Ministry of National Education. However, the cultural capital of families was also taken into account, using the parents' qualifications in the analyses discussed above, and this often appeared more related to children's educational success than the parents' profession. Subsequently, it was economic capital, as measured by household income, that was used to analyse educational results (Goux & Maurin, 2000).

By necessity or choice, student surveys sometimes use social background indicators other than parents' qualification or household income: indeed, students do not necessarily know this information very reliably. The PISA survey, for example, bases much of its measurement of the family environment on the possession of various goods (cars, televisions, computers, books, etc.). In this perspective, the number of books at home appears to be one of the variables most related to educational outcomes and a question on this topic is now often included in education surveys (PISA, PIAAC, student panels of DEPP). Of course, this should be interpreted with caution: if having books at home can be an asset in itself to academic achievement, it is probably also a sign of a certain level of income (to buy and store books) and a certain level of culture (expressed in the choice of expenditure).

The characterisation of the student is often supplemented by information on the family (such as living with both parents, the number of siblings, the position among these siblings, etc.) or on the students themselves (gender or geographical origin). Geographical origin, analysed through the nationality and country of birth of the student and/or their parents, is the subject of specific studies in French work (Vallet & Caille, 1996) and the importance of the ethnic category in American studies is well known. Of course, gender is also information often used to study educational questions, sometimes combined with social inequality (e.g. Duru-Bellat *et al.*, 2001).

Here, we take an extensive approach to educational inequalities, where students are characterised both on the conventional register of their parents' qualification and profession, and by information on the type of family and number of siblings, as well as the geographical origin and gender of the student.

1.2. How Do We Measure Educational Inequalities?

As Godin & Hindriks (2018) highlighted, there are many methods for measuring educational inequalities (for an overview, see Felouzis, 2014). In line with the extensive approach to educational inequalities adopted here, we will favour a global indicator, the coefficient of determination, the R^2. An econometric model will be constructed, linking a quantitative measure of academic achievement to a set of individual characteristics (social origin, gender, etc.), where the R^2, i.e. the share of the variance explained by the factors included in the model, indicates the extent of the correlations. If a single explanatory, quantitative, variable was used, the R^2 would correspond to the square of the correlation coefficient with the explained variable. The closer the value is to 1, the greater the inequalities. Conversely, an indicator close to 0 indicates relatively low inequalities.

The counterpart of this global indicator, which allows simple comparison of different populations (see Box) is, however, like any synthetic indicator, an insensitivity to margins; therefore, it can correspond to different situations under the same value. Thus, the same R^2 can be associated with models of a different form: for a population, the predominant factor will be cultural capital, measured by the parents' qualification, whereas in another model with the same R^2 it will be income. Even with a single factor (as in the analyses carried out with the ESCS index in PISA), an R^2 can refer to different levels of gross inequalities: the same social gap may be associated with a larger gap in skills score in one population than in another, but if the score dispersion is also larger in the first population, the R^2 may be the same. For this reason, we will also present the coefficients associated with each variable in the main models estimated for IVQ and PIAAC, for scores and education level indicators. The problem, of course, is that some unobserved social factors may be more important in one population than in another: the R^2 will in this case underestimate the inequalities in the first population.[6] Moreover, the interpretation of the R^2 also requires upstream inequalities to be taken into account. Indeed, the same R^2, the same model, has a different meaning depending on whether it affects a very heterogeneous population (with, say, many rich and many poor people) or not (with a strong middle class): the dispersion of the results (for example, the standard deviation of the score) will be lower in the second case.

This methodology can be applied to skills scores summarising responses to exercises or to the school leaving age that, while not entirely continuous, are both quantitative in nature. However, the level of education or the qualification, which are discrete variables, are not suitable for this type of analysis.

To compare inequalities in skills and in educational level, Place & Vincent (2009), using IVQ, took educational level as a reference and sought to present skills scores in a comparable form. They have divided these scores into hierarchical groups of comparable size to the qualification distribution. They then used ordered polytomic logistic regressions. Reverse standardisation has been applied here, taking skills scores as a benchmark and seeking to make the level of education comparable in a quantitative form. To this end, we first define education levels taking into account both the level of training completed and whether or not the corresponding qualification has been obtained (e.g. having reached the 12th grade and obtained, or not, the baccalaureate, Bac hereafter). Each level of education is then assigned the corresponding average overall score (see values in Table 2).[7] This method is similar to various attempts to "quantify" the social environment, such as the PISA indices (see for example Rocher, 2016, who sought to quantify the occupations of parents available in the information systems of the Ministry of National Education). Here, the dimension on which the levels of education are projected is reduced to the measurement of skills. In what follows, we will refer to the 'quantified education level'. In a way, this modelling presents the differences in scores that should be observed if the skills at the end of education were deduced directly from the level of education. Other choices for quantification of the level of education are possible (e.g. takink the age of completion of studies as a reference, using polytomic regression); they give fairly similar results (see Online Appendix – link at the end of the article). In addition, models using the school leaving age will also be presented.

2. Inequalities in Skills and in Levels of Education Are Quite Similar

2.1. A Strong Link Between Skills and Education Level

Because skills are measured on scales that are partly arbitrary, it is customary, especially when several measures are used, to standardise the data by setting the standard deviation to 1,

6. *In the case of a linear model (such as the one used by the OECD to link PISA scores to the ESCS), another risk of underestimating inequalities may come from the non-linear form of the relationship. In this article, because all the explanatory variables are qualitative, the problem does not arise as such, but one can transpose the criticism by considering that the combinations of modalities that we had to make, given the rather small sample, are not optimal. The results may also be sensitive to the distribution of the dependent, quantitative variable. The variations on quantification of the level of studies presented in the Online Appendix show some robustness of the results on this point.*
7. *It is therefore a projection of the levels of education on a competency axis. The variance of this variable is therefore lower than that of the original skills score. To facilitate comparison, this quantified education level indicator has been standardised, assigning it the same mean and standard deviation as the overall competency score.*

Box – **The comparison of the R^2**

Here we present some theoretical elements which allow for statistical inference based on the comparison of R^2. Usually, a Fisher test can verify that the R^2 is significantly different from 0, which is not sufficient here. The Chow test (1960) allows comparison of a model with the same variables over two different populations, but it is normally significant as soon as one parameter differs in the two regressions. For example, it is sufficient for the constant to be different. Now, in this case, the R^2 is the same, as are the inequalities.

The comparison tests between two R^2 are complicated by the fact that these are indicators restricted between 0 and 1. In the case of Pearson's correlation coefficient between two variables, Fisher (1921) has proposed a transformation to correct this problem:

$$z = \frac{1}{2}\ln\left(\frac{1+\rho}{1-\rho}\right)$$

the variable thus obtained is supposed to follow approximately a normal law of variance $\frac{1}{N-3}$. Olkin & Finn (1995) proposed solutions for R^2 of a more general model. They give the following formula as an approximation of the variance:

$$V\left(R^2\right) = \frac{4r^2\left(1-r^2\right)^2\left(n-k-1\right)^2}{\left(n^2-1\right)\left(n+3\right)}$$

where r^2 is the observed value, n is the number of observations and k is the number of degrees of freedom used by the model.

The second problem relates to the size of samples, sometimes rather small, for some sub-populations. We know that the R^2 increases mechanically when we add variables to a model. A similar problem arises when the sample size is reduced, even randomly: the model will improve its explanatory power, because there is less information to explain. To solve this problem, we have chosen the solution used to correct the bias mentioned above when adding explanatory variables: the adjusted R^2, which does not depend on the number of variables taken into account in the model:

$$R_a^2 = 1 - \frac{\left(1-R^2\right)\left(n-1\right)}{n-k-1}$$

the variance of this estimator is fairly easily deduced from that of the R^2 indicated above (a multiplicative factor close to 1 distinguishes them).

We did an empirical check of these formulae: of the 1,483 respondents to IVQ in 2004 and 2011, we conducted a random draw of one in two people (giving a sample equivalent in size to those of 2004 and 2011 taken in isolation), we calculated the gross R^2 and adjusted R^2 (using the model on the overall score) for this population. This operation has been repeated 1,000 times.

This simulation confirms the overestimation of the R^2 in small populations: whereas the value over the 1,483 observations is 21.4%, the mean over the 1,000 sub-samples is 24.2%, i.e. a difference of 2.8 points. The adjusted R^2 does a little better, but does not appear to entirely solve the problem: the value over the 1,483 observations is 20.2%, while the mean over the 1,000 sub-samples is 21.8%, i.e. a difference of 1.6 points. The Olkin & Finn formula seems to give a good estimate of the dispersion of the estimate: for a sample of about 700 individuals, it gives a value of 2.6 points (see values for IVQ 2004 and IVQ 2011 in Table 3). However, the dispersion of the estimates over the 1,000 sub-samples is 2.7 points.

the differences between populations being given as percentages of standard deviation (standard deviation points, referred to hereafter simply as "points").[8]

According to IVQ, the 18- to 29-year-olds had significantly better results than the 30- to 65-year-olds, more evidently in reading than in calculation or oral comprehension (Table 1): in reading, they were separated by 40 points, compared with about 20 points in calculation and oral comprehension. This larger gap in reading probably stems from the fact that the exercises in this skill were more numerous, allowing a more precise and less "noisy" measure. To summarise the results and ensure measurement reliability, two global scores were constructed: one combining the three areas, the other only reading and calculation results. If the first score gives a broad view of the skills, the second more directly measures the skills developed in school; this is why it will be preferred in the comparison with the level of education. The results are very close when the population is restricted to young people who have just completed their studies (more precisely, less than five years before the survey).[9]

8. To give some meaning to these differences, it is worth noting that those close to the average passed about three-quarters of the items offered in the skills assessment (the assessment was fairly easy); those 50 points below this average had a success rate of 68%; those 50 points above this average had a success rate of 86%. See Murat (forthcoming) for a more detailed description of the exercises.

9. We introduce an age restriction, both to make an overall comparison between young people and older generations, and for technical reasons. On the one hand, young people aged 16-18 years old were not interviewed in IVQ 2004. To ensure consistency between 2004 and 2011, we remove them from 2011 (however, they remain in the scope of PIAAC). Those over 29 were excluded, because in PIAAC the question of education is less constrained by the fact that it relates to initial schooling: there are several older people amongst those leaving education, suggesting many resume their studies. The impact of these choices on the measurement of inequality appears to be quite limited (see footnote 11).

Table 1 – **Reading, numeracy and oral comprehension skills by age**

	Reading (R)	Numeracy (N)	Oral comprehension (O)	Overall score R+N	Overall score R+N+O
18–65 years	0	0	0	0	0
30–65 years	-0.09	-0.04	-0.04	-0.07	-0.07
18–29 years	0.30	0.13	0.19	0.24	0.26
18- to 29-year-olds having finished their studies less than 5 years before the date of the survey	0.31	0.15	0.21	0.26	0.29

Reading note: The mean and the standard deviation of each score were fixed at 0 and 1, respectively, for the population of 18- to 65-year-olds. In reading, people aged 30 years or older, with the value -0.09, are located at 9% of the standard deviation below the average for the population as a whole. The overall score for R+N is the mean of the scores in reading and numeracy (as it is restandardised, it is not achieved by averaging the columns R and N). The score for R+N+O includes oral comprehension.
Sources and coverage: INSEE, IVQ 2004 and 2011; people aged 18 to 65, metropolitan France in 2004 and 2011.

The hierarchy of performance at the highest education level achieved is well in line with what is expected based on the required number of years of education (Table 2). Young people leaving after a general or technological course at age 16 without any qualification are 76 points below the average, while those having obtained a CAP or a BEP (qualifications at the end of lower secondary high school) are 3 points above. Those who have reached higher education perform better (48 points for Bac+2; 96 points for Bac+3 or 4 and 112 points above average for Bac+5). These are the averages that will be used to measure the quantified education level mentioned above.

However, the correlation between education level and skills score is not perfect (the correlation coefficient between the two variables is 0.57) and about 10% of those leaving from a Bac+5 level (unfortunately it is not possible to know whether they obtained the corresponding diploma or not) do not exceed the value 0, i.e. roughly the average performance over the entire population. Conversely, about 15% of young people having left education at age 16 are above this threshold. Nonetheless, among these early leavers, many others have a performance that brings them closer to illiteracy (60% have a score below -0.5 compared to 4% of leavers from a Bac+5 level). Moreover, even if the proximity of skills and educational attainment implies that inequalities will overlap significantly, the skills gaps at the end of education are not necessarily the same as the usual inequalities, depending on qualification.

Table 2 – **Reading/numeracy skills according to level of education**

	Distribution (%)	Mean	Standard deviation	S<-0.5	-0.5<S<0	0<S<0.5	S>0.5	Age at completion of studies
At most 2GT – No qualification	4	-0.76	1.18	60.0	25.5	7.6	6.9	16.9
At most 2GT – Secondary school leaving certificate or higher	4	-0.52	0.94	51.5	30.3	12.5	5.7	17.7
CAP/BEP – Not achieved	6	-0.46	0.92	41.8	23.1	25.7	9.4	17.8
CAP/BEP – Achieved	14	-0.19	0.88	36.5	21.6	21.5	20.4	18.8
Voc. baccalaureate – Not achieved	2	-0.39	0.61	53.3	13.0	25.4	8.3	19.4
Voc. baccalaureate – Achieved	8	0.14	0.87	18.7	22.6	34.3	24.5	20.1
Tech. baccalaureate – Not achieved	2	-0.19	0.81	25.1	31.6	26.6	16.6	19.5
Tech. baccalaureate – Achieved	4	0.10	1.02	19.9	17.2	32.2	30.7	19.7
General baccalaureate – Not achieved	2	0.07	0.83	20.8	37.6	15.5	26.2	19.0
General baccalaureate – Achieved	3	0.12	1.04	28.1	12.3	17.9	41.7	20.1
Bac+2 – Not achieved	8	0.31	0.82	12.6	13.2	36.7	37.5	20.9
Bac+2 – Achieved	16	0.48	0.81	9.5	19.0	21.4	50.1	21.6
Bac+3/4 – Not achieved	2	0.50	0.84	14.1	18.7	14.2	53.0	22.8
Bac+3/4 – Achieved	9	0.96	0.79	6.4	6.0	15.3	72.3	22.7
Bac+5	14	1.12	0.85	4.1	4.7	13.1	78.1	24.2
Other	1	-0.70	1.09	82.5	4.5	10.8	2.2	19.1
Total	100	0.26	1.01	22.1	17.0	21.4	39.5	20.7

Note: 4% of young people have not gone beyond first year of general and technological lycée (equiv. sixth form) without the secondary school leavers' certificate. They have a mean score of -0.76 in reading/numeracy (76 standard deviation points below the mean); 60% of these young people have a score of less than -0.5.
Sources and coverage: INSEE, IVQ 2004 and 2011; young people aged 18 to 29 who completed their studies less than five years before the survey date, in metropolitan France in 2004 and 2011.

2.2. Close Inequalities in Skills and in Education Level

Given the samples' size, which are quite limited for some populations studied, we have restricted the number of variables and modalities. However, even with a limited characterisation of the young people and their environments, inequalities appear to be quite significant (Table 3): 27.5% of the variance in the quantified education level, one-fifth of the overall skills score and the age at which education is completed can be explained by the characteristics of the young person. Skills inequalities seem slightly lower, but this dimension is estimated with a significant measurement error, reducing the correlations. The R^2 for the quantified education level is also sensitive to the quantification method used, but variants show some robustness of the results to the specification (see Online Appendix). The overall skills score (using the three areas, including oral comprehension), has a level of inequality that is very slightly lower than that of skills in reading and calculation, because the differences in oral comprehension are lower (the R^2 is 8.5%, versus 14.4% in calculation and 19.2% in reading). The test of oral comprehension is indeed rather short, which makes the measurement less precise, but this is also the case with the test of calculation. It is certainly the less academic nature of oral comprehension that explains less marked inequalities.

As expected, significant differences in skills, quantified education level or age of ending studies appear, depending on the number of siblings, the parents' qualification or occupation: young people whose father graduated from higher education perform 42 points higher than those whose father does not have a qualification, and they are separated by one and a quarter years of study.

Young men have a higher skills score than young women: this is mainly due to higher performance in calculation, whereas the results are equal in reading and oral comprehension. In contrast, young women have a higher quantified education level, which translates into half a year more education.

Family type is not associated with differences in skills. In contrast, a deficit of two-thirds of a year of study is found for young people who have not lived with both parents during childhood. Material difficulties, common for single-parent families, may have hampered the school choices of these young people.

Young people born abroad[10] have lower skills than those born in France (about one-third of standard deviation). The gap is not significant for qualifications. As for the age of completing school, the situation is reversed: the fact that the young person was born abroad is associated with three-quarters of a year extra study; arrival in France may have resulted in a shift in schooling or repeating the year. Foreign-born young people's quantified education level is therefore higher than their skills scores. This seems consistent with research that, according to Vallet & Caille (1996), has shown that, at a given skills level, immigrants' children leave primary school with a higher educational level than the rest of the population.

It is also interesting to compare the skills score and the quantified education level of leavers with some information on the course of these studies, particularly at their start, controlling the variables used in the previous model (Table 4). Interpreting these correlations is, of course, more complex because of possible reverse causality: repeating a year usually results from learning difficulties at the beginning of primary school; this being associated with lower skills in adulthood is therefore explained much more by this initial selection effect than by the negative effectiveness of this treatment. However, this means that repeating did not allow for a complete catch-up (a goal which, it is true, is ambitious for pupils who start out far behind the others in terms of skills). For example, half of the overall standard deviation score separates young people who have or have not repeated a year at primary school, to the benefit of those who have not. The gap is even more striking in terms of years of schooling: young people who have repeated a year finish their studies a year earlier, while repeating a year exactly corresponds to one extra year of schooling.

The age of starting kindergarten gives rise to significant differences. It should be noted that in 1980-1990, the 2-year-old enrolment rate was higher than it is today: one in three pupils. For skills, there are no differences between the most frequent situations (starting at age 2 and 3); only deferred starts (at age 4) are associated with weaker performance (one third of standard deviation). More unexpectedly, a small effect can be seen for the quantified level of education (15 standard deviation points) for pupils starting

10. This geographical origin criterion was preferred to a definition parents' country of birth because, as it identifies fewer individuals, it gives rise to greater deviations. Given the size of the sample, it was not possible to combine these highly correlated criteria.

Table 3 – **Modelling of skills, quantified education level and age at completion of studies depending on the characteristics of the young people**

	Overall score		Quantified level of studies		Age at completion of studies	
Constant	0.07	ns	0.98	***	22.40	***
Gender (*Ref.: Female*)						
Male	0.10	**	-0.23	***	-0.58	***
Living with both parents (*Ref.: Yes*)						
No	0.06	ns	-0.27	***	-0.64	***
Born in France (*Ref.: Yes*)						
No	-0.40	***	0.08	ns	0.73	***
Number of siblings (*Ref.: 3 or more*)						
None	0.40	***	0.43	***	0.89	***
1	0.38	***	0.37	***	0.70	***
2	0.33	***	0.18	***	0.46	***
Type of accommodation during childhood (*Ref.: Flat other than council accommodation*)						
House	0.01	ns	-0.14	**	-0.30	*
Council accommodation	-0.21	**	-0.42	***	-0.67	***
Father's qualification (*Ref.: Higher education*)						
Qualification unknown	0.30	ns	-0.30	ns	-1.58	**
No degree/qualification or primary school certificate (CEP)	-0.42	***	-0.57	***	-1.10	***
BEPC/CAP/BEP/Bac	-0.13	ns	-0.15	ns	0.05	ns
Mother's qualification (*Ref.: Higher education*)						
Qualification unknown	-0.25	ns	-0.49	**	-0.76	ns
No degree/qualification or primary school certificate (CEP)	-0.32	***	-0.37	***	-0.80	***
BEPC/CAP/BEP/Bac	-0.12	ns	-0.19	**	-0.40	*
Father's occupation (*Ref.: Blue-collar worker*)						
Profession unknown	-0.52	***	-0.02	ns	0.89	*
Farmer, craftsman, shop owner	0.17	**	0.14	*	0.10	ns
Managerial/teacher, middle-management	0.23	***	0.24	***	0.51	***
White-collar worker	0.11	ns	0.07	ns	0.07	ns
Mother's profession (*Ref.: Blue-collar worker*)						
Profession unknown	-0.05	ns	0.08	ns	0.51	**
Farmer, craftswoman, shop owner	-0.19	ns	0.07	ns	0.68	**
Managerial/teacher, middle-management	0.09	ns	0.16	*	0.77	***
White-collar worker	0.01	ns	0.14	**	0.48	***

Population	Number	R^2 (in %)					
Leavers (18- to 29-year-olds having finished their studies less than five years before the date of the survey)							
in 2004 and 2011	1,483	19.7	(1.9)	27.5	(2)	18.1	(1.8)
in 2004	725	20.7	(2.7)	31.3	(2.8)	18.1	(2.6)
in 2011	762	21.8	(2.7)	26.5	(2.7)	19.1	(2.6)
in reading (R)	1,483	19.2	(1.8)				
in numeracy (N)	1,483	14.4	(1.7)				
in oral comprehension (O)	1,483	8.5	(1.5)				
of the overall R+N+O score	1,483	19.1	(1.8)				
Leavers without age conditions (persons 16 years of age and older who completed their studies less than five years before the date of the survey)							
in 2011	815	21.8	(2.6)	27.2	(2.5)	19.6	(0)
Young people aged 16–18							
in 2011	499	24.6	(3.3)				

Note: This table shows the results of a set of linear regressions of the combined score for reading and numeracy, of the level of education (in quantified form, with a standard deviation identical to the score) and of the age at completion of studies. The top part gives the coefficients for the different variables used, of the model relating to leavers in 2004 and 2011: compared with women, all the other variables being fixed, the men have an overall score that is 0.1 higher, i.e. 10 points of standard deviation, a quantified level of studies of 23 standard deviation points lower and finish their studies 0.58 before the women. The asterisks system takes into account the significance of the coefficients (*** at 1%; ** at 5%; * at 10%). The first line of the second part of the table gives the R^2 (more precisely the adjusted R^2) of these three linear regressions. The following lines show this R^2 either for the scores in each discipline or for particular populations. The standard errors of the R^2 are shown between parentheses.
Sources and coverage: INSEE, IVQ 2004 and 2011; young people aged 18 to 29 who completed their studies less than five years before the survey date (unless otherwise stated), in metropolitan France in 2004 and 2011.

Table 4 – **Modelling of skills, quantified level of studies and age at completion of studies (additional)**

	Overall score		Quantified level of studies		Age at completion of studies	
Model variables in Table 3 under control	Yes		Yes		Yes	
Number of changes of institution (*Ref.: 2 or more*)						
None	-0.15	**	0.06	ns	0.29	ns
1	-0.24	***	-0.04	ns	0.25	ns
Repeating a year (*Ref.: Yes*)						
No	0.57	***	0.54	***	1.07	***
Age upon starting nursery school (*Ref.: 2 years*)						
3 years	-0.07	ns	-0.15	***	-0.09	ns
4 years	-0.39	***	-0.22	***	-0.13	ns
Frequency of reading at 8–12 years old (*Ref.: Never*)						
Every day	0.40	***	0.53	***	1.39	***
Regularly	0.35	***	0.47	***	1.29	***
From time to time	0.13	**	0.23	***	0.54	***
R^2 in 2004 and 2011 (in %)	28.8	(2.0)	37.0	(2.0)	24.7	(1.9)

Note: This table presents linear regressions of the combined overall score in reading and numeracy, the quantified level of studies and age at completion of studies, based on the models presented in Table 3 (the coefficients corresponding to the variables of these models are not presented here) by adding information on the course of schooling. The last line gives the R^2 (more precisely the adjusted R^2) with the standard errors in parentheses.
Sources and coverage: INSEE, IVQ 2004 and 2011; young people aged 18 to 29 who completed their studies less than five years before the survey date, in metropolitan France in 2004 and 2011.

school at age 2 compared to those starting at 3, but the difference is not confirmed by the school leaving age. One possible explanation is that starting school at age 2 may have enabled a number of pupils to move up a year (by skipping a class in pre-primary school), which, without raising their skills, allowed them to reach a higher level of education. It is also possible that families seeking to have their child enrolled at 2 years of age are also those who push for long-term education.

Finally, reading practices during childhood (between 8 and 12 years of age) are also a good predictor of skills and the quantified level of education attained in adulthood: 40 points separate those who read daily or regularly from those who never read, in terms of overall skills score. The gap is even greater in terms of the quantified education level (close to 50 points) and translates into more than one extra year of studies.

Overall here, the inequalities in skills seem to be quite close to the inequalities in quantified education level. The differences appear to be greater for the quantified level of education (R^2 of 27.5% *vs.* 19.7% for the overall skills score). This result depends on the accuracy of the measurement of skills, and how we quantified the education level, but it is consistent with what Place & Vincent (2009) obtained with a different methodology for measuring the level of education. With respect to the shape of the model, most variables point in the same direction (for example, the parents' profession and qualification), with a few exceptions (regarding gender, family type or country of birth).

The results presented indicate an overall level of inequalities close to that observed with secondary or primary school assessments. Can we go further and compare the extent of educational inequalities at different points in schooling? Have they evolved over time and are they comparable in France and other countries? These issues are those of the next section.

3. Change in Inequalities over Time and Across Countries

3.1. Skills Inequalities Remained Stable between 2004 and 2011

Since the early 2000s, the results of the PISA survey, as well as those of the national surveys by the DEPP, point to an increase in the dispersion of skills at age 15 and the social inequalities associated with them. With IVQ data, an increase in social inequalities is also observed for more recent generations (Murat & Rocher, 2016).

Amongst the leavers studied here, inequalities appear to be of the same magnitude in 2004 and 2011: the share of variance in the overall skills score explained by the characteristics of the young people (model in Table 3) increases from 20.7% to 21.8%.[11] Given the confidence interval around these values, the gap cannot

11. Note that, for 2011 on a sample broadened to leavers aged 16–18 years and over 29 years (these two populations account for about 2% of leavers), the R² for the overall score is 23.1%, which is quite close to that on the restricted sample (21.8%).

be considered significant. This result does not contradict those reported on PISA, because young people completing their studies in 2011 are more like the generation that passed PISA in the early 2000s, i.e. before social inequalities increased.[12]

3.2. Skills Inequalities in PIAAC

The information available in PIAAC on the individuals is somewhat more limited than in IVQ: the person's gender and geographical origin, the parents' qualifications and the number of books available in the household when the respondent was 16 years old. However, these characteristics give a relevant picture of educational inequalities, as they explain, in France, 21.4% of the variance in the literacy score, 22.3% of the variance in the numeracy score and 23.0% of the quantified level of education, calculated using the same methodology as that used on IVQ (Table 5). About 40 standard deviation points in literacy separate young people whose mother does not have a qualification from those whose mother has completed higher education (30 points in numeracy). The difference is of one standard deviation between those who had less than 10 books at home at age 16 and those who had at least 500 books.

To compare the results of PIAAC and IVQ, we must stick to the variables available in both surveys: gender, country of birth of the young person and the parents' qualifications. The

12. *To our knowledge, there has been no comparison between IALS, ALLS and PIAAC to study changes in social inequality (contrary to what was done on the average level, concluding that there was some stability in most countries that participated in the three surveys). The resumption of PIAAC in 2022 will allow for study of this issue over a period in which, in France, changes are observed in PISA.*

Table 5 – **Modelling of PIAAC scores, school education level and age at completion of studies in France**

	Literacy		Numeracy		Quantified level of studies		Age at completion of studies	
Constant	-0.42	ns	-0.68	**	-0.03	ns	21.99	***
Gender (*Ref.: Female*)								
Male	-0.07	ns	0.24	***	-0.19	**	-0.59	**
Born in France (*Ref.: Yes*)								
No	-0.43	**	-0.51	**	0.23	ns	1.82	***
Father's qualification (*Ref.: Higher education*)								
No degree/qualification or primary school certificate (CEP)	-0.32	**	-0.32	**	-0.29	*	-1.26	***
Bac/CAP/BEP	-0.19	ns	-0.25	*	-0.26	**	-0.72	*
Qualification unknown	-0.42	**	-0.49	***	-0.72	***	-1.64	***
Mother's qualification (*Ref.: Higher education*)								
No degree/qualification or primary school certificate (CEP)	-0.32	**	-0.34	**	-0.43	***	-0.46	ns
Bac/CAP/BEP	-0.24	*	-0.18	ns	-0.42	***	-0.81	**
Qualification unknown	-0.44	**	-0.49	**	-0.45	**	-1.20	*
Number of books at home at age approx. 16 (*Ref.: Over 500 books*)								
Fewer than 10 books	-0.95	***	-0.95	***	-0.71	***	-1.72	***
11 to 25 books	-0.76	***	-0.83	***	-0.45	**	-1.16	*
26 to 100 books	-0.27	ns	-0.35	*	-0.16	ns	-0.18	ns
101 to 200 books	-0.20	ns	-0.23	Ns	0.22	ns	-0.05	ns
201 to 500 books	-0.03	ns	-0.16	Ns	-0.04	ns	-0.29	ns

Population	Number	R^2 (in %)							
Complete model									
France	486	21.4	(3.3)	22.3	(3.3)	23.0	(3.3)	13.4	(3)
Other participating countries	12,752	21.9	(0.6)	21.7	(0.6)	23.3	(0.7)	14.9	(0.6)
Complete model over the 16–18 years									
France	486	21.7	(3.6)	19.9	(3.5)				
Other participating countries	12,752	21.5	(0.8)	22.2	(0.8)				
Model without the number of books									
PIAAC leavers	486	13.9	(3)	15.8	(3.3)	16.9	(3.1)	10.6	(2.7)
IVQ leavers	1,483	13.0	(1.6)			18.3	(1.8)	16.0	(1.8)

Note: This table shows linear regressions of literacy and numeracy scores, quantified education level and age upon completion of studies. The top of the table gives the coefficients for the models on the leavers. The second part gives the R^2 (more precisely the adjusted R^2) of these models and then for a variant without the number of books available (for comparison with IVQ), on sub-populations of PIAAC.
Sources and coverage: OECD-PIAAC 2012; 18- to 29-year-olds who completed their studies less than five years earlier, in 2012 (or 16–18 year olds).

quality of the models drops significantly: the coefficients of determination drop to 13.9% in literacy and 15.8% in numeracy. This illustrates the importance of the number of books at home as an indicator of the cultural environment. The same modelling using IVQ gives close results: 13.0% for the overall skills score, 18.3% for the quantified education level (compared with 16.9% for PIAAC) and 16.0% for school leaving age (compared with 10.6% for PIAAC).[13]

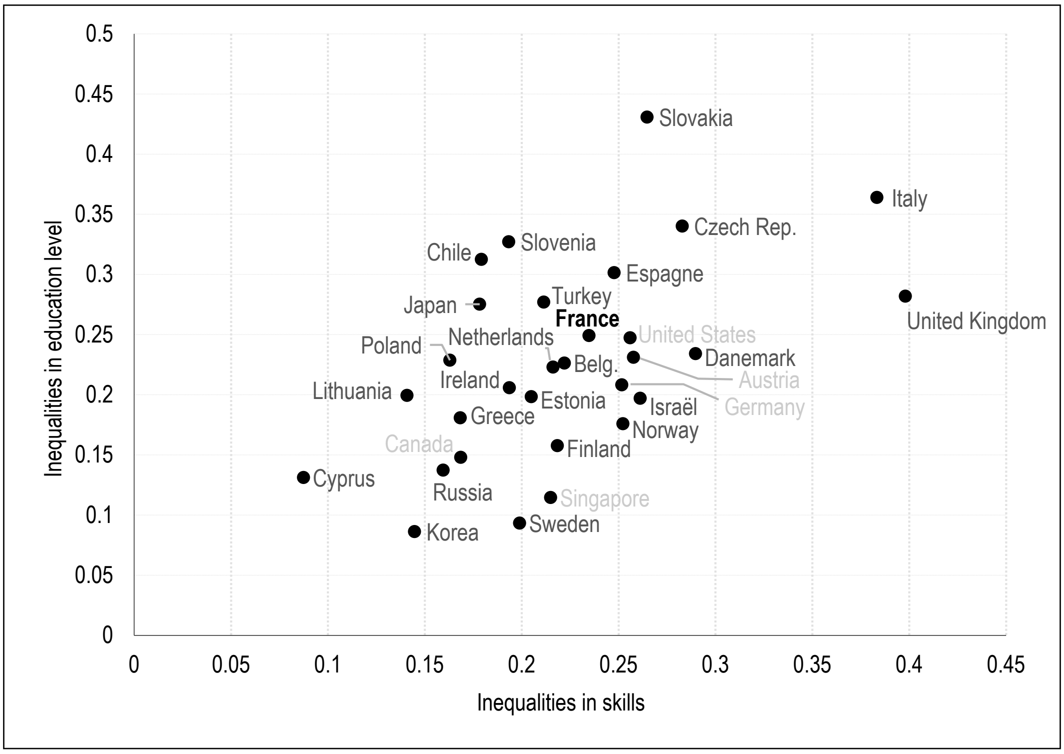
Using the indicators from the full model, the R^2 are quite close to those estimated in other countries (21.9% in literacy and 21.7% in numeracy). This seems consistent with the first PISA surveys, which did not find too high a level of social inequality in France in the early 2000s. More precisely, if France is at an average level in terms of inequalities, whether in skills or in quantified education levels, there are clear differences between countries (see Figure). These two measures seem to be fairly correlated: Italy, the United Kingdom, the Czech Republic and Slovakia are countries where inequalities in skills and the quantified education level are high (with the R^2 exceeding 25% for both indicators); in Cyprus and Korea, on the other hand, the two indicators are quite low (less than 15%). However, the trend is not perfect and, for an average level of inequalities in skills (around 20%), some countries, such as Sweden, limit the inequalities in the quantified level of education (R^2 of 10%), whereas these are higher in other countries (R^2 of 33% in Slovenia).

3.3. Changes in Skills Inequalities between the End of Compulsory Education and the End of Education

This article provides a picture of skills inequalities at leaving education, a point in schooling generally not studied on the issue of skills. Can these results be compared with those observed at the end of compulsory schooling? Borgonovi *et al.* (2017) have compared, in detail, the PISA and PIAAC surveys and shown that, despite some protocol differences, the two surveys were very similar in their objectives and methods. This justified, in particular, the comparison between the results in PISA 2000 and 2003 and those in PIAAC, particularly in terms of social inequalities. They compared two populations which are *a priori* similar: the 15-year-olds

13. *The gap is larger for the latter variable. Note that the age at the end of studies is defined in a slightly different way in IVQ and in PIAAC: in IVQ, it is asked directly and followed by questions detailing the educational pathway; in PIAAC, the first question relates to the highest qualification and the date of graduation is then requested. This is likely to help include more continuing education (the average age of leaving education is higher in PIAAC than in IVQ), which are less sensitive to social conditions.*

Figure – **Inequalities in skills and inequalities in education level in different countries**



Note: This graph shows the R^2 of the models linking the indicators of educational achievement to the characteristics of the young people. Grey indicates countries for which age at completion of studies is not disclosed; in this case, all 18- to 29-year-olds who have completed their studies longer than five years ago have been retained.
Sources and coverage: OECD-PIAAC 2012; young people aged 18 to 29 who completed their studies in 2012.

in 2000 and 2003 and the 26-28-year-olds in PIAAC in 2012. In most countries, particularly France, social inequalities appear a little more pronounced for the 26-28-year-olds than for the 15-year-olds. Such work was also carried out including observation at the level of primary school, with the PIRLS and TIMSS surveys (Dämmrich & Trigenti, 2016). This obliges the authors to retain the only variable common to all surveys: the number of books at home. Across all countries considered, they observe stability or even increased inequalities (especially in mathematics) between primary school and early adulthood. In France, for the assessment of reading only, the trend is more towards stability.

We propose a few additional elements by comparing the results of the 16-18-year-olds and those of leavers using IVQ (2011) and PIAAC. In relation to the work of Borgonovi *et al.* (2017), this has the disadvantage of not comparing the same cohorts, but the advantage is that the measures of skills and social environment are exactly the same (which is not quite the case in a comparison between PISA and PIAAC). With both surveys, the magnitude of the skills inequalities appears very similar between the two populations. With PIAAC, in France, the R^2 for literacy and numeracy is 21.7% and 19.9% for the 16-18-year-olds, close to the values for leavers (21.4% and 23.3%, the difference of 3.4 points in numeracy is not significant). The same is true for all participating countries: in numeracy, as in literacy, for the 16-18-year-olds or leavers, the R^2 only slightly deviates from 22% (varying between 21.7% and 22.2%).[14] With IVQ, the R^2 for the 2011 overall score for the 16-18-year-olds is not significantly different from that for leavers (24.6% and 21.8%, respectively).

* *
*

At the end of education, skills inequalities are significant in France, as in other participating countries: between a fifth and a quarter of the variance in skill scores can be explained by the descriptors used here. This is a low estimate: a more detailed description of the social environment and a more precise measurement of skills would probably increase the correlation significantly. These inequalities overlap with the long-standing inequalities that have been evident at educational levels, but only partly. In the analysis of young people's occupational integration or their entry into adult life, the skills therefore provide additional information, in particular on the influence of the social background.

The skills inequalities upon leaving school appear very close to those at age 16-18 (also close to those reflected in assessments of students at the end of compulsory schooling, such as based on PISA). Indeed, research into high school value-added indicators has shown that continuing to high school is essentially dependent on the level of skills attained at the end of secondary school (measured by the results of the national secondary school leavers' certificate), and that the social environment then plays a relatively small role beyond its impact on success at secondary school (Evain & Evrard, 2017). □

14. The same model can be applied to PISA 2012 data. The values are close to the average of the countries participating in the two surveys (R^2 = 24% in literacy and R^2 = 21.4% in numeracy). By contrast, for France, as stated in the introduction, PISA shows more inequalities (31.8% and 32.3%). A lower level of inequality in France may mean either that the PIAAC assessment is less discriminatory in France, or that the variables in the social environment are of lower quality.

Link to the Online Appendix:
https://www.insee.fr/en/statistiques/fichier/6005373/ES528-529_Murat_Annexe-en-ligne_Online-Appendix.pdf

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