5

Proficiency Growth before and after Age 15

A defining feature of proficiency growth after the age of 15 is that high performers did not acquire skills as fast as low performers and, as a result, some groups of students who had performed poorly at the age of 15 were able to close some of the gap in reading skills by the age of 24. This chapter provides further evidence of proficiency convergence by examining how family and school environments are related to reading proficiency at age 15 and to skills growth between the ages of 15 and 24. One important finding is that individuals who are more inclined to self-directed learning do not do as well in the highly structured environments often found in compulsory education, but they appear to thrive in environments that allow for greater autonomy.

SKILLS GROWTH IN PISA-24

One of the most striking findings of the descriptive analysis presented in Chapter 3 was the varying rate of growth in reading skills between the ages of 15 and 24 that, in many cases, led to a narrowing of the skills gap and allowed certain groups, particularly immigrant students, to eliminate entirely the gap that had previously separated them from high-performing students.

This chapter expands on the descriptive analysis presented in Chapter 3 by examining the relationship between positive early environments and continuing improvements in proficiency. The chapter begins by considering how initial reading proficiency is related to skills growth after age 15. It examines the relationship between reading proficiency at age 15 and improvements in reading proficiency growth between the ages of 15 and 24; the influence of positive early environments later on in a young person's life; and the specific student characteristics that translate into greater improvements in reading proficiency after 15.

SKILLS GROWTH AND INITIAL READING PROFICIENCY AT AGE 15

The observed relationship between skills at age 15 and skills growth

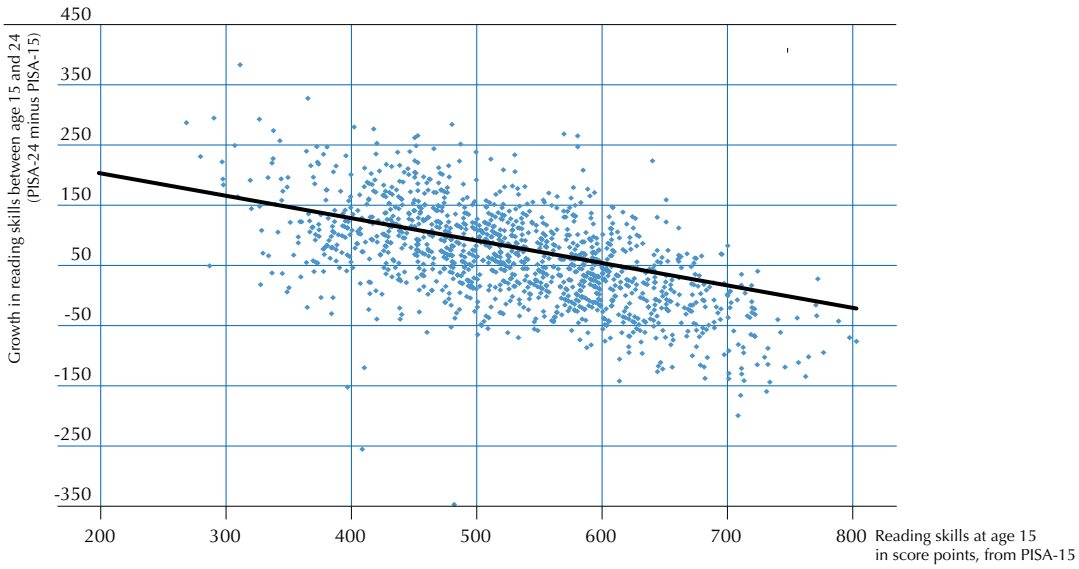
The difference in PISA scores between 15-year-olds and 24-year-olds shows that students who scored the lowest at the younger age tended to make the largest gains in proficiency by the time they were 24. In other words, PISA-24 shows evidence of convergence in skills between the ages of 15 and 24.

Figure 5.1 offers a first glimpse of the relationship between all of the assessment data in PISA-24. With skills at age 15 represented on the horizontal axis and skills growth on the vertical axis, each dot represents an individual who participated in both PISA-15 and PISA-24. Table 5.1 in Annex B presents the details of this analysis. As the table shows, this estimated difference in skills growth remains practically unchanged after individual student characteristics and other relevant factors are taken into account.

Figure 5.1 shows that the higher the initial level of skills, the smaller the improvement in skills over the nine years. Because of the nature of the reassessment, this is the expected pattern. However, it is unclear to what extent this pattern is an artefact of the assessment mechanism. As discussed in Chapter 2, however, these simple estimates of skills growth may overstate the rate of catching-up among poor performers due to the potential bias introduced by regression towards the mean (see Annex A for a technical discussion).

■ Figure 5.1 ■

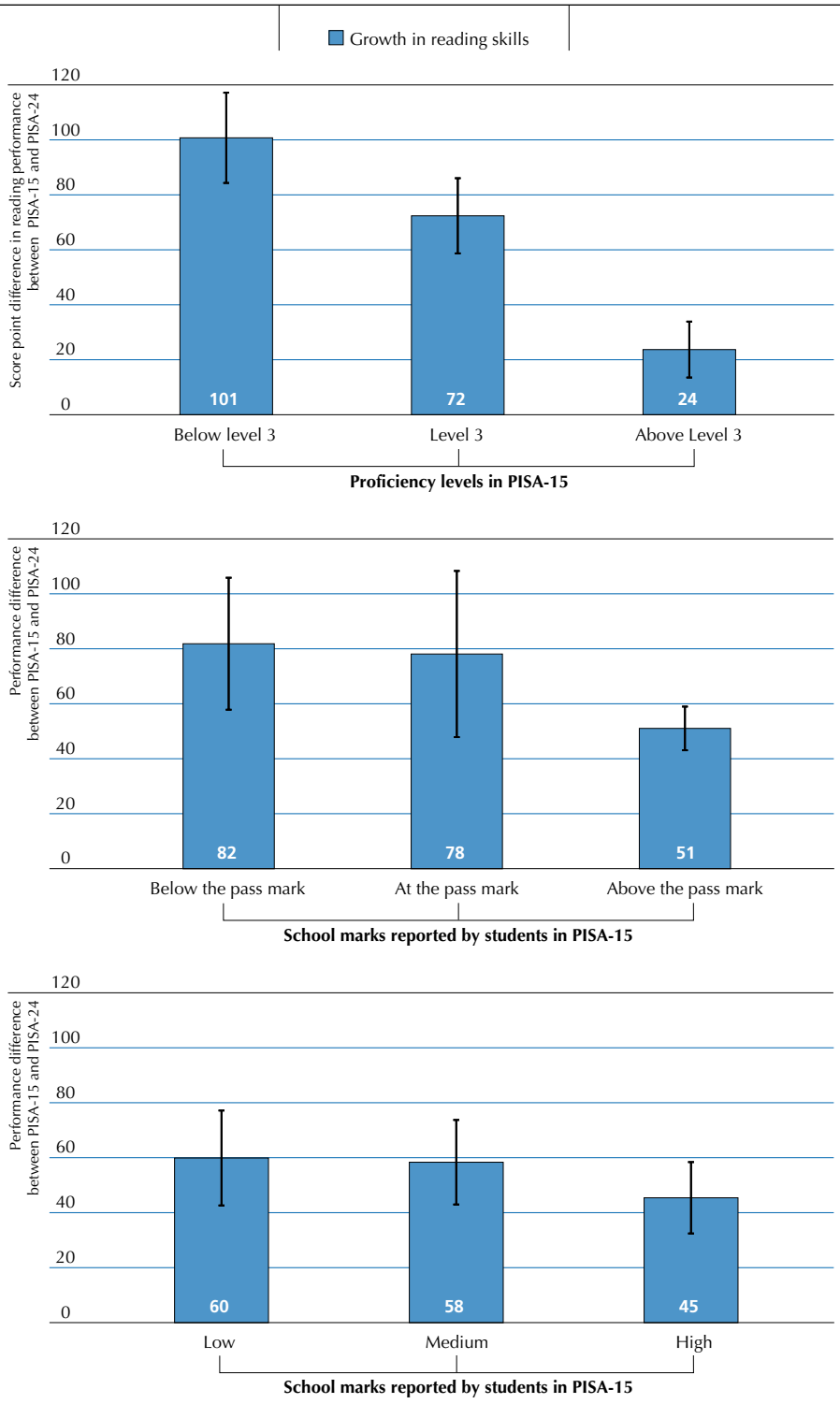
Observed relationship between reading skills at age 15 and growth in reading skills between the ages of 15 and 24



Source: Table 5.1; YITS cycle 5.5: Reading Skills Reassessment.
StatLink http://dx.doi.org/10.1787/888932576833

■ Figure 5.2 ■

Development of reading skills by PISA proficiency levels and school marks at age 15



Note: The second figure refers to the self reported grades in language by the participants when they were 15 years old in PISA 2000. "Low" refers to obtaining below 70%, "Medium" refers to obtaining from 70% to 79% and "High" refers to obtaining at or above 80%. The vertical lines on each measure of mean skill growth indicate the degree of precision with which these average scores are calculated. In statistical terms, the range of score points in terms of skill growth covered by these lines is referred to as the confidence interval. In general, overlapping vertical lines (joined confidence intervals) suggest that the differences are not statistically significant with a high degree of confidence (95% in this case).

Source: Table 5.1; YITS cycle 5.5: Reading Skills Reassessment.

StatLink http://dx.doi.org/10.1787/888932576833

Adjusting for initial skills with school marks

Analysing skills growth across proficiency levels in PISA offers a way of looking at this phenomenon. For instance, Figure 5.2 shows that skills growth between the ages of 15 and 24 averaged around 24 points for students above PISA proficiency Level 3 in 2000, but was more than 100 points for students below Level 3 (Table 5.1). As discussed in Chapter 2, however, these simple estimates of skills growth may overstate the rate of catching-up among poor performers due to the potential bias introduced by regression towards the mean (see Annex A for a technical discussion).

One way to verify the relationship between early proficiency and skills growth is to examine learning gains by a different measure of early ability, namely school marks.

PISA-15 asked students to report their most recent school marks in reading, mathematics and science. Only self-reported school marks in high school language classes were used in this analysis due to the focus on reading skills in PISA-24. Two measures of school marks were used to test the relationship between initial skills and skills growth. In the first instance, students reported their marks in relation to the passing grade – 9% were below the passing mark, 12% were at the passing mark, and 76% were above the passing mark. In the second instance, students reported their marks as a percentage. These have been categorised into three groups, low school marks (below 70%), medium school marks (between 70% and 79%), and high school marks (at or above 80%), with each group containing approximately one-third of students (Table 5.1).

The results, presented in Figure 5.2, provide evidence that supports the argument that skills growth was in fact greater among students with lower proficiency. For example, skills growth among those with marks below passing at the time of PISA-15 improved by more than 80 score points. In contrast, those with marks above passing in 2000 improved by 50 score points by 2009. The same pattern is observed using the other measure of school marks. Those with high marks show the smallest improvement in proficiency, around 45 score points, while those with low marks improved by an average of 60 score points (Table 5.1).

The relationship between learning gains and school marks in language, though weaker than that between skills growth and PISA-15 scores, provides further evidence that poorly performing students made some progress in closing the gap in reading skills. These results suggest that opportunities for learning after the completion of compulsory education can mitigate some of the inequalities observed at age 15.

A CONCEPTUAL MODEL OF IMPROVEMENT IN READING PROFICIENCY

To provide a framework for the in-depth analysis of skills growth that follows, this section presents a conceptual model for considering skills acquisition before and after the age of 15. This simplified representation of reality offers a stylised model to analyse the data. PISA-15 and PISA-24 represent a three-point measurement cycle during a person's early life: at birth, at age 15 and at age 24 (Figure 5.3). The three time points define two distinct phases of skills growth. Although the PISA reading proficiency scale has no relevance for young children, it is constructed to measure skills that students have accumulated from birth to age 15 (OECD, 2001).

The first phase in skills development in this model takes place from birth to age 15, and is measured by PISA-15. This phase is characterised by natural variations in cognitive skills and the quality of the individual's learning environment in and outside school. During this phase, the most important determinants of proficiency development are parents, teachers and formal schooling.

The second phase of learning on this model takes place between the ages of 15 and 24, and is measured by the difference in performance between PISA-15 and PISA-24. Phase two marks the transition from extrinsic and passive reception of learning (in compulsory education) to intrinsic and active self-determination (after the completion of compulsory education). This phase is characterised by more individual choices regarding education and training, and practicing existing skills in work and leisure.

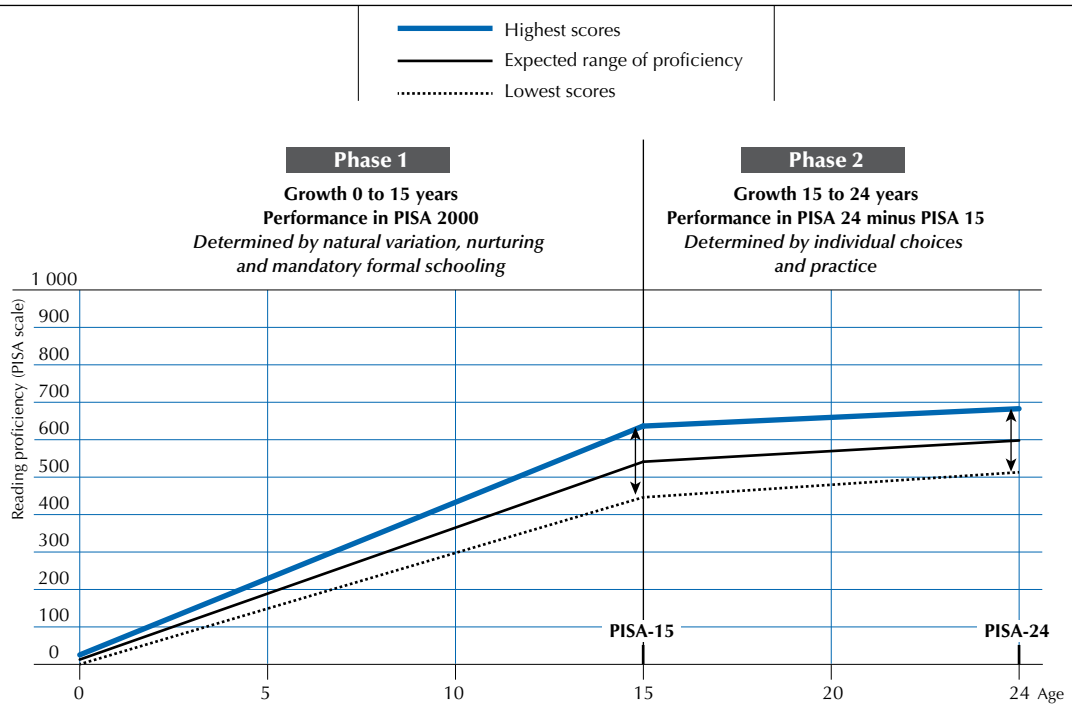
In both phases, learning opportunities are not distributed equally among young people. Up to the age of 15, many students will enjoy environments and support networks that provide rich learning opportunities. Of course, students will differ in the extent to which they enjoy and benefit from these resources, depending on, for example, whether they live in urban or rural areas, or whether their families provide additional support and opportunities to learn.

The transition from extrinsic and passive reception of learning opportunities to intrinsic and active self-determination can be either beneficial or detrimental to the rate of development of an individual's reading proficiency. Young people

who benefited from advantageous early environments may be unable to replicate the richness of their early learning experiences. The cost of developing certain skills, through post-secondary education, for example, may be too high. However, it is also possible that students who lacked adequate learning support during the first phase of their reading development may later be able to seek out positive learning environments.

■ Figure 5.3 ■

Growth phases in reading proficiency and their determinants



Source: YITS cycle 5.5: Reading Skills Reassessment.

StatLink http://dx.doi.org/10.1787/888932576833

Ideally, the freedom of choice in the years after compulsory education would allow for remediation of any inequities that arose during earlier learning. However, at least three factors limit such remediation. First, freedom of choice in learning opportunities depends on having universal access to those opportunities, which requires well-funded and well-distributed post-secondary and adult secondary learning programmes. Second, individuals must be assisted in bearing the short-term costs associated with long-term learning pathways, particularly if they come from socio-economically disadvantaged backgrounds. Third, disadvantages in the first phase of learning may limit the capacity of an individual to develop new skills, a factor that increases in importance with advancing age and slower neural development.

POSITIVE LEARNING ENVIRONMENTS BEFORE AND AFTER AGE 15

PISA-15 showed that a number of factors were associated with better individual performance at age 15 (phase one). PISA-24 offers an opportunity to examine the relationship between these factors and skills growth after 15 (phase two).

PISA-24 suggests that, as the opportunities for learning become more diverse, self-directed individuals are more successful in seizing those opportunities. In the transition out of compulsory education into post-secondary education or the labour market, skills acquisition is greater among those who thrive on their own or can successfully replicate the kinds of support mechanisms offered by their families, teachers and schools. In fact, the factors that tend to be associated with better performance at age 15 do not, in general, continue to have a positive relationship to skills growth after 15. In some cases, the opposite is true: factors that had a negative association with performance at age 15 tend to be weakly but positively related to skills growth after age 15. A negative relationship does not mean that individuals experienced skills loss, but rather that their pace of growth was slower.

PISA-15 collected information from students and their parents on their family background, learning environments and approaches towards learning. From school principals, PISA-15 collected information on the school environment. This section examines some of the data gathered from these two questionnaires, dividing them into two broad categories: the family environment and individual engagement, and the school environment.

This section describes the simple observed relationships between these factors and skills growth in phases one and two. The next section analyses these relationships in a more complex model that investigates how these factors interact with one another. In particular, the initial skills level is one of the strongest determinants of skills growth after age 15. Therefore, when examining the relationship between the early learning environments of young people and their skills growth in phase two, it is important to control for the initial skills level. Otherwise, the raw correlations of the variables with skills gains may be caused by the overriding effect of skills convergence, rather than the true effect of the variables themselves. As has been documented in Chapter 2 and elsewhere, regression towards the mean renders the PISA-15 score an inappropriate control for initial proficiency. As a result, the following analysis was conducted for three groups of students defined by their school grades, in order to control for differences in results among students with higher and lower initial reading skills.

Supportive family characteristics and individual approaches to learning

PISA evidence shows that many student and family characteristics are closely related to performance at age 15. While these characteristics provided an advantage in early skills growth, they appear to be either negatively related or unrelated to skills growth after age 15, with one exception. A student's belief that he or she is in control of his/her life had a positive impact on skills growth. Interestingly, this characteristic was associated with slower skills growth in the first phase of a young person's development.

Figure 5.4 depicts the relationship between family and individual characteristics with skills growth in phases one and two. The variables are classified along three dimensions: socio-economic status, family support, and individual approaches to learning. A positive sign represents a positive relationship; the more positive signs, the stronger the relationship. The inverse holds for negative signs. Statistically significant estimates are marked in bold. Table 5.2 in Annex B provides detailed results.

■ Figure 5.4 ■

Relationship between supportive family characteristics and individual approaches to learning, reading performance at age 15, and improvement in reading skills between the ages of 15 and 24

Criteria for:

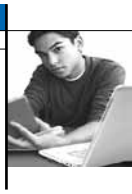
+	Stands for a positive correlation	–	Stands for a negative correlation
++	Stand for a positive correlation above 0.07	– –	Stand for a negative correlation above 0.07
+++	Stand for a positive correlation above 0.15	– – –	Stand for a negative correlation above 0.15

School marks in language

Supportive family characteristics and individual approaches to learning	High		Medium		Low	
	Phase 1 (PISA-15)	**Phase 2** (PISA-24 - PISA-15)	**Phase 1** (PISA-15)	**Phase 2** (PISA-24 - PISA-15)	**Phase 1** (PISA-15)	**Phase 2** (PISA-24 - PISA-15)
Socio-economic status						
Highest parental education	+ +	–	+ +	–	**+ + +**	–
Highest parental occupation	+ +	+	**+ + +**	– –	**+ + +**	–
Family support of learning						
Cultural communication	**+ + +**	+	**+ + +**	– –	**+ + +**	–
Family educational support	+ +	–	– –	+ +	– –	+
Individual approaches to learning						
Sense of mastery[1]	–	+	– – –	+ +	–	+

1. Sense of mastery is a variable collected only in Canada through the PISA-24 survey implemented along with PISA-15.

Note: An statistically significant correlation is highlighted in bold.
Low school marks refers to obtaining below 70%, Medium school marks refers to obtaining from 70% to 79% and High school marks refers to obtaining at or above 80%.
Source: Table 5.2; YITS cycle 5.5: Reading Skills Reassessment.



Socio-economic status

Parents' education and occupation are two components of family background that are closely related to student performance at age 15 but are not related to skills growth after 15. Parents' education and occupation are measured by the highest level of achievement in the respective areas by the father and the mother. Parents' education and occupation are both closely related to student performance, particularly among those students with average and high school marks at age 15. The relationships are strong and substantial. For example, among those with high school marks the correlation between the highest parental occupational status and performance in PISA-15 is 0.24. However, the correlation between the highest parental occupational status and skills growth after 15 is negative and very weak, -0.02 (Table 5.2). The same pattern is seen for both these variables, regardless of the students' school marks. If anything, the negative relationship to skills growth was more pronounced among those individuals who, at age 15, had medium school marks.

Family support of learning

PISA-15 collected data on two aspects of family support for learning: parental cultural communication with their 15-year-olds and help with schoolwork and homework.

Cultural communication refers to the frequency with which parents discuss political or social issues, talk about books, films or television programmes, or listen to classical music with their children, as reported by the students at age 15. Cultural communication in the family has been shown to have a positive relationship with performance at age 15 (*PISA 2009 Results*, Volume II, OECD 2010c).

Cultural communication at home helps students thrive at age 15, but it has no lasting effect on skills growth beyond then. It is possible that students who had enjoyed higher levels of parental engagement do not maintain the same intrinsic motivation after they lose this support. The correlations between performance in PISA-15 and cultural communication are positive across all groups of students, regardless of their school marks. This positive relationship is particularly strong (positive correlation of 0.29, among the strongest of all analysed here) among those who, at age 15, had medium school marks. Yet it is precisely for this group that the relationship between cultural communication and skills growth after 15 is most negative (-0.11). While this negative relationship is not statistically significant, it is among the most negative observed in this analysis. For individuals with high school marks at 15, the relationship is also positive at age 15 and turns negative, although the relationship is weaker. For those with low marks, the relationship at age 15 is still positive, but weak, and the relationship with skills growth after 15 remains positive (Table 5.2).

Assistance with schoolwork and homework refers to the frequency with which parents or siblings worked with 15-year-olds. In contrast to cultural communication, help with schoolwork has a complex association with performance at age 15. PISA data suggest that when students struggle with their homework, parents are more likely to offer assistance. Therefore, the relationship between support for schoolwork and performance in PISA tends to be negative. As shown in Figure 5.4, the relationship with skills growth after 15 is weak, but positive (Table 5.2).

Individual approaches to learning

Beyond the variables measured by PISA-15 across all countries, Canada extended the student questionnaire to include questions relating to an individual's sense of mastery – the belief that one has control over one's destiny. The inspiration for this scale is the concept of external versus internal locus of control. A large body of research literature has highlighted this issue in the context of learning.[1]

PISA-24 results highlight the importance of a strong sense of self-determination for learning beyond compulsory education. During compulsory education, which is usually characterised as a supportive environment, a sense of mastery appears to be associated with less skills growth. However, beyond compulsory education, when learning takes place in a less structured manner, a sense of mastery seems to be positively related to skills growth.

A respondent's sense of mastery is defined as "the extent to which one regards one's life chances as being under one's own control in contrast to being fatalistically ruled" (Pearlin and Schooler, 1978). The concept of mastery was measured using the student questionnaire in YITS that was distributed with PISA-15.[2] Individuals were asked about the extent to which they agreed with the following statements: "I often feel helpless in dealing with the problems of life"; "I have little control over the things that happen to me"; "There is little I can do to change many of the important things in life"; "There is really no way I can solve some of the problems I have"; "Sometimes I feel I'm being pushed around in life"; "I can do just about anything I really set my mind to"; and "What happens to me in the future mostly depends on me". The sense-of-mastery scale was then developed by combining their answers.

While a sense of mastery is negatively related to performance at age 15, it is positively related to skills growth after age 15. For example, for the group of individuals with medium school marks at age 15, the correlation between a sense of mastery at age 15 and performance in PISA-15 is -0.30 and the correlation with skills growth after 15 is 0.12. In both cases, the correlations are consistent across groups, but they are not statistically significant. The pattern is similar for those with high and low school marks at age 15 (Table 5.2).

Supportive school learning environments

PISA-15 collected a wealth of information from students and school principals about school policies and practices. Focusing on those shown to have had a positive relationship to performance, this section classifies them into the following subcategories: school characteristics (size and average socio-economic intake); student perceptions of the school environment; school resources; teacher characteristics and engagement; school use of resources for instruction; school governance; and school climate.

The analysis of supportive school environments reveals similar findings to that of supportive family structures. In general, supportive school characteristics and policies that have a positive relation to skills acquisition at age 15 do not have a positive effect on skills development after age 15. In contrast, several factors that were negatively related to performance at 15 were positively related to skills growth after 15.

The relationships between the environment at school and skills at 15 and skills development after 15 are explored in Figure 5.5. A positive sign represents a positive relationship; the more positive signs, the stronger the relationship. The inverse holds for negative signs. Statistically significant estimates are marked in bold. Table 5.2 in Annex B provides detailed results.

■ Figure 5.5 ■

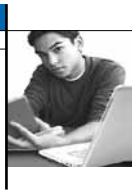
Relationship between supportive school learning environments, reading performance at age 15, and improvement in reading skills between the ages of 15 and 24

Criteria for:

+	Stands for a positive correlation	-	Stands for a negative correlation
++	Stand for a positive correlation above 0.07	- -	Stand for a negative correlation above 0.07
+++	Stand for a positive correlation above 0.15	- - -	Stand for a negative correlation above 0.15

	School marks in language					
	High		Medium		Low	
	Phase 1 (PISA-15)	**Phase 2** (PISA-24 - PISA-15)	**Phase 1** (PISA-15)	**Phase 2** (PISA-24 - PISA-15)	**Phase 1** (PISA-15)	**Phase 2** (PISA-24 - PISA-15)
School characteristics						
Average school socio-economic profile	**+ + +**	- -	**+ + +**	- -	**+ + +**	-
School size	**+ + +**	- -	+ +	-	**+ + +**	- -
Student perception of school environment						
Student-teacher relations	+	-	+ +	- -	+ +	+
School achievement pressure	- - -	+ +	- - -	+ +	**- -**	+ +
School resources						
School education resources	- -	+	-	+	- -	+
School material resources	-	+	+ +	+	+	-
Teacher characteristics and engagement						
Student-teacher ratio	+	+ +	**+ + +**	**- - -**	+ +	-
Teacher shortage	**- - -**	+ +	+	-	-	-
Proportion of specialized reading teachers	**+ + +**	**- - -**	-	+ +	**+ +**	-
Teacher morale	+ +	+ +	-	+	+	-
Teacher participation in decision making	+ + +	- -	- -	+ +	+	+ +
Instructional time						
Total instructional hours	+	-	-	+	+	+ +
School governance						
School autonomy	+	+	**+ + +**	- -	+	+ +
School climate						
Supportive school environment	+ + +	- -	+ +	- -	+ +	+
Student behaviours	- -	+	+	- -	-	-
Teacher behaviours	-	+	+	- -	-	+

Note: An statistically significant correlation is highlighted in bold.
Low school marks refers to obtaining below 70%, Medium school marks refers to obtaining from 70% to 79% and High school marks refers to obtaining at or above 80%.
Source: Table 5.2; YITS cycle 5.5: Reading Skills Reassessment.



School characteristics: School socio-economic intake and school size

The average socio-economic background of students in a school – the school's socio-economic intake – is strongly and positively related to student performance in PISA-15, and weakly and negatively related to skills growth after 15. This pattern is evident across all groups of students, regardless of school marks at age 15. As with other variables, the result is most noticeable for students with medium school marks. The correlation between school socio-economic intake and student performance in PISA-15 is 0.32, the strongest correlation estimated in this exercise; its correlation with skills growth after age 15 is -0.09, a weak correlation (Table 5.2). The pattern is similar for those with high and low school marks at age 15. In general, a more advantaged socio-economic intake can mean a more supportive environment for learning: for example, it is associated with a better disciplinary climate. It is also possible that socio-economically advantaged students have a positive effect on the learning outcomes of their peers. However, PISA-24 results suggest that individual socio-economic background at age 15 does not continue to have a positive effect in phase two. In fact, those without this supportive environment at age 15 tend to acquire skills at a faster rate once they leave school. The results for school size are mixed and inconsistent, particularly for age 24.

Student perceptions of the school environment

PISA-15 asked students to report on a number of issues related to their school environment. The analysis here focuses on two that were shown to be particularly relevant in the Canadian context: teacher-student relations and school pressure to achieve.

The scale of teacher-student relations at age 15 was based on the answers students provided when they were asked to report the extent to which they agree with the following statements: "Students get along well with most teachers"; "Most teachers are interested in students' well-being"; "Most of my teachers really listen to what I have to say"; "If I need extra help, I will receive it from my teachers"; and "Most of my teachers treat me fairly".

School pressure to achieve at age 15 measured the extent to which students' felt that teachers emphasise academic performance and are demanding of their students.[3] The scale was built on students' reports on the frequency with which "the teacher wants students to work hard"; "the teacher tells students that they can do better"; "the teacher does not like it when students deliver careless work"; and "students have to learn a lot".

In general, a positive and supportive environment at school – as measured by teacher-student relations reported by the students – is weakly but positively related with performance at age 15 and weakly but negatively related with skills growth after 15. The change is most dramatic among those with average school marks at age 15. For this group, the correlation between teacher-student relations and skills at 15 is 0.14; the correlation with skills growth after 15 is -0.13 (Table 5.2). Neither correlation is particularly substantial, but they are not inconsequential either. For the group of students who had low school marks, the pattern is similar but the relationships are weaker. For the group that achieved high school marks, however, both relationships are positive, but they are also weak. This mixed evidence suggests that if a supportive school environment does have a positive impact on skills at age 15 that impact does not continue beyond compulsory education.

Pressure to achieve was weakly and negatively related to performance in PISA-15 across all groups of students, regardless of their school marks; in contrast, it was weakly and positively related to skills growth after 15, although the estimates of the relationships with both outcomes are statistically imprecise. For the group of students with high school marks, the relationship with performance at 15 is negative, but not very substantial (the actual correlation is -0.13, one of the lowest statistically significant correlations estimated for this exercise). The correlation with skills growth after 15, however, is 0.11 (Table 5.2). For the other groups of students, the correlations are approximately the same size and in the same direction, i.e. negative for skills at 15 and positive for skills growth after 15. These results confirm the longer-term associations (albeit weak) between pressure to achieve and performance after compulsory education, and suggest a need to better understand how achievement pressure operates in both the longer and shorter terms among students with differing achievement levels

School resources

PISA-24 evidence on school resources is inconclusive. There is no consistent relationship between either educational or material resources and performance at age 15 or skills growth after 15, regardless of the students' school marks. All relationships are weak and change from positive to negative or vice versa. For example, better educational resources are negatively related to performance at age 15, but positively related to skills growth after age 15 across all groups.

In contrast, better material resources are negatively related to performance at age 15 for those with low school marks, but positively related for those with high or average school marks.

That resources are only weakly related to skills is not surprising. The evidence from every PISA cycle shows that resources *per se* are not the main driver of school success. A large body of evidence from national assessments and other research and policy studies concludes the same. In general, the emphasis is on quality and how resources are used. For example, *Quality Time for Students: Learning in and out of School* (OECD, 2011b) argues that it is not so much the amount of time students spend learning, but rather how they use that time that counts.

Teacher characteristics and engagement

PISA-15 asked school principals about school enrolment and the size of their teacher staff to calculate student-teacher ratios. They were also asked to assess whether a shortage of teachers was hindering learning in their school. To evaluate teacher quality, the questionnaire distributed to principals asked about the proportion of teachers who were specialised in language instruction, given the focus on reading in PISA-15.

The importance of teachers and teaching for skills at age 15 is highlighted in this analysis; but PISA-24 also shows that, with some exceptions, this positive relation does not translate into positive effects on the rate of skills acquisition after the age of 15. The exceptions are found among measures of teacher engagement at school (morale and participation) that appear to be positively, albeit weakly, related to skills growth as well as skills acquisition at 15.

PISA moved beyond these relatively simple and objective measures and assessed teacher engagement at school. In particular, principals were asked to report on teacher morale and teacher participation in decision making. The scale of teacher morale was based on principals' reports on the extent to which they agree with the following statements: "The morale of teachers in this school is high"; "Teachers work with enthusiasm"; "Teachers take pride in this school"; and "Teachers value academic achievement." The teacher participation scale was based on principals' reports on the number of areas (staffing, budgeting and instruction) where teachers have the main responsibility (Adams and Wu, 2003 and OECD, 2001 provide more details on how each of these scales were built).

The availability of teachers, particularly specialised language teachers, has a weakly positive relationship to skills at 15 and a complex relationship to skills growth after 15. The proportion of specialised teachers is positively related to performance in PISA-15 and negatively related to performance in PISA-24 among those with low school marks at age 15. For the group of individuals with high school marks at 15, the relationships follow the same pattern, but they are weaker. For the group with medium school marks, the relationship changes from negative to positive. Across the other two measures of human resources at school, the results are equally mixed. For example, the student-teacher ratio is weakly and positively associated with performance at 15 and skills growth after 15 among those with low school marks. Teacher shortage is weakly and negatively associated with performance at age 15 and with skills growth after 15.

Teacher morale and teacher participation in decision making are generally only weakly related to skills growth in either PISA or PISA-24, and the relationships are inconsistent across grade levels, making it difficult to identify a pattern.

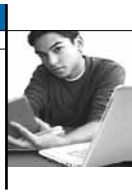
Instructional time and school governance

In PISA-15, school principals reported on the total number of school hours per year for the typical 15-year-old attending their school. The relationship between instructional time and skills at 15 is generally positive but weak. Among students with high school marks, group instructional time at age 15 is positively related to skills growth after the age of 15.

PISA-15 asked school principals to report on whether schools, rather than local or national authorities, had the primary responsibility for school administration, staffing, compensation, budgeting, admissions, and the curriculum. School autonomy is positively and weakly related to skills at age 15 and skills growth after age 15 among individuals with low and high school marks at age 15.

School climate

School principals provided information on student behaviour by reporting on the extent to which instruction in their school was hindered by: student absenteeism; disruption of classes by students; students skipping classes; students lacking respect for teachers; the use of alcohol or illegal drugs; and students intimidating or bullying other students. A scale for teacher behaviour was also developed based on school principals' reports on the extent to which instruction was being hindered by: low expectation of teachers; poor student-teacher relations; teachers not meeting individual



students' needs; teacher absenteeism; staff resisting change; teachers being too strict with students; and students not being encouraged to achieve their full potential. A composite index of supportive school environments, produced in the context of Canada and shown to be related to skills at age 15 is also analysed.[4]

While a supportive school environment tends to be positively related to skills at age 15, there is a weak but generally negative relationship with skills growth after 15. This is particularly true for students with average or below average reading marks.

Student and teacher behaviours appear to be mostly unrelated to reading skills growth in either PISA-15 or PISA-24.

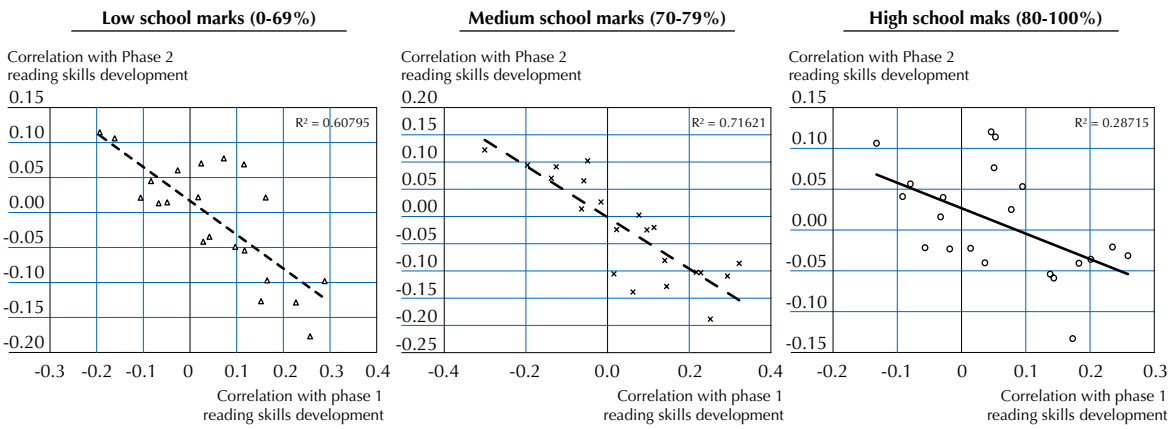
Box 5.1 **Dichotomy between phase one and phase two growth**

When examined individually, many of the relationships are small and statistically insignificant. However, taken together, the relationships between these variables to phase-one and phase-two growth forms a fairly consistent story.

The dichotomy between the role of positive influences at age 15 and age 24 is illustrated in Figure 13, which plots the correlations between the previously examined indices and proficiency growth in both periods of time. There are three data series in the panel of figures below that show the correlations for three different samples based on initial proficiency level. Each point in these figures gives the correlation between a given index and proficiency growth in the two time periods. The horizontal axis gives the correlation to phase-one growth, and the vertical axis to phase-two growth. Accordingly, data points in the top left of the space indicate a moderate positive correlation to growth after age 15 and a negative correlation to growth before age 15. Conversely, data points in the bottom right indicate negative correlations to growth after age 15 and positive correlations to growth prior to age 15. Data points in the bottom left and top right indicate negative and positive correlations, respectively, in both time periods.

■ Figure 5.6 ■

Relationship between correlations with PISA questionnaire indices and reading performance at age 15 and at age 24



Source: YITS cycle 5.5: Reading Skills Reassessment.
StatLink http://dx.doi.org/10.1787/888932576833

The inverse relationship between proficiency growth in the two time periods indicates that students who had positive early learning conditions likely developed correspondingly strong skills, but any improvements outside of this environment were smaller. The negative correlations for later proficiency improvements do not indicate that higher values on the indices represent a reduction in skills. Rather, they indicate that skills growth did not occur as quickly as for other individuals. In short, individuals who enjoyed positive school experiences early in their lives may be unlikely to replicate those experiences later on.

PROFICIENCY GROWTH OUTSIDE THE CLASSROOM

The analysis above highlights several indices that were expected to have positive associations with reading performance at age 15 yet in fact had negative associations. These three factors are: sense of mastery, family educational support, and school pressure to achieve. To build on the results presented so far, this section analyses the relevance of these three variables jointly in a multiple regression. Two key contextual factors at age 15, socio-economic status and supportive school environment, were also included in the analysis. The same model was estimated separately for the three groups of students based on high school grades. The estimated effects on skills growth of an increase of one unit in the indices measuring these factors are shown in Table 5.3.[5]

A supportive school environment and family socio-economic status are both associated with better performance in PISA-15, after accounting for all the other factors included in this joint model. In contrast, both of these factors are negatively related to skills growth between the ages of 15 and 24. The negative relationships estimated for these two variables are indicative of skills convergence observed for youth after 15 (Table 5.3). Likewise, the effects of the sense of mastery, family educational support and school pressure to achieve change between PISA-15 and PISA-24: the impact on skills growth is negative at age 15 and positive at age 24.

While supportive school environments and socio-economic advantage benefit students generally, family educational support and pressure to achieve are specific to learning. The negative coefficients for these two factors during skills growth before the age of 15 indicate that students with poor initial reading skills tend to receive (or perceive) greater family educational support and school pressure. However, the positive coefficients for growth between the ages of 15 and 24 indicate that these personal interactions may produce residual effects that last even after students have left their school and family environments.

The relationship to sense of mastery suggests how these effects may relate to development in phase two. As discussed above, a sense of mastery describes the extent to which an individual feels he/she has control over his/her life. At age 15, students with a strong sense of mastery were not among the most proficient readers in general. For children and adolescents, successful learning and growth can be characterised as more dependent on trusting the decisions and direction of authority figures, such as teachers and parents. Therefore, it is understandable that students who may resent or resist this authority may have poorer learning outcomes. The positive estimates for skills growth in phase two suggests that once these young adults are beyond the environment where most of their learning decisions are made by external authorities, that is after the age of 15, those with a strong sense of mastery will be more likely to make decisions that result in a faster rate of skills acquisition. Youth who were pushed to succeed by their parents and teachers may similarly be more likely to choose avenues that lead to greater skills gains once they are making decisions on their own.

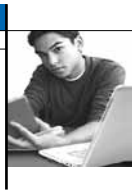
WHAT IS THE NET EFFECT OF POSITIVE EARLY LEARNING ENVIRONMENTS?

Although many factors related to early reading development may have a weak or negative association with skills growth after the age of 15, they are associated with other developmental outcomes and life choices that may provide even greater long-term advantages in terms of skills maintenance. Positive early learning environments tend to foster decision making associated with positive learning later on in life.

Like many other factors, even though skills growth between the ages of 15 and 24 may be slower for those in the most advantageous early environments, the initial advantage lasts. Table 5.4 presents data on skills at age 15 and 24 along four measures of learning environments at age 15: sense of mastery, family educational support, cultural communication and socio-economic background.

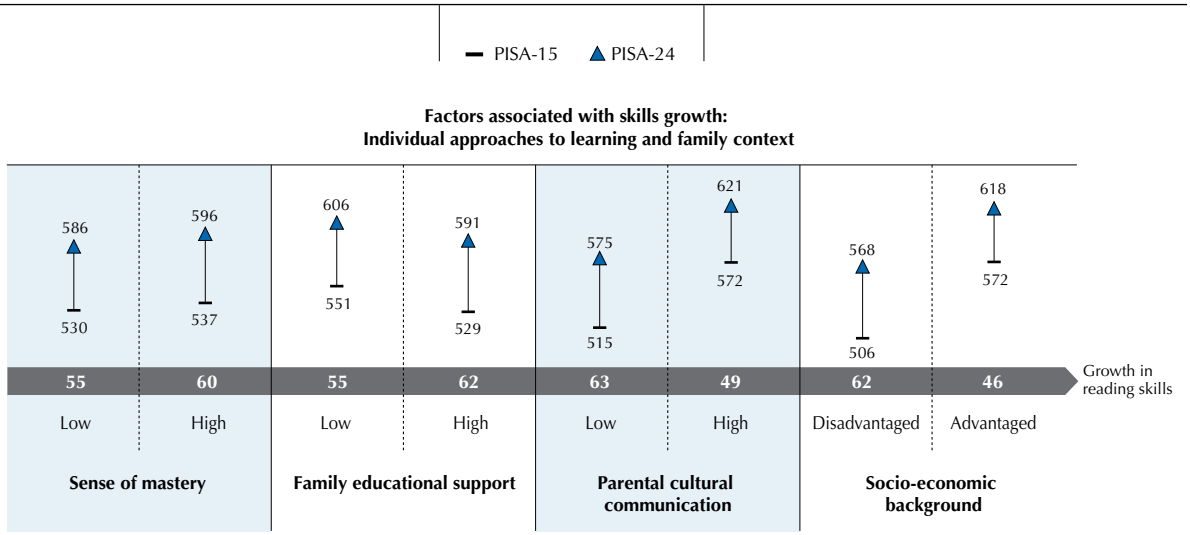
The results are presented for each level of parental education (Table 5.4), and for the top third and bottom third of youth on each of the indices (Figures 5.7 and 5.8).

Figure 5.7 shows, for example, that while skills growth was faster among individuals who did not enjoy frequent parental cultural communication (63 score points versus 49 score points), the average score at age 24 for those with less parental communication at age 15 (575 score points) barely catch up with the skills at age 15 of those who enjoyed more parental communication (572 score points). In general, though skills growth was greater among youth from less-advantaged environments, the faster growth was not sufficient to erase the early lead among those youth who enjoyed a more advantaged learning environment in their early years.



■ Figure 5.7 ■

Improvements in reading skills between the ages of 15 and 24, by individual and family-related factors associated with skills at age 15

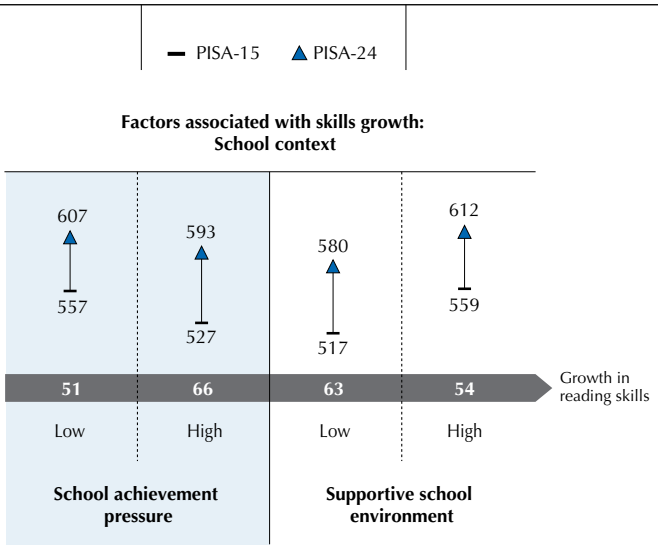


Source: Table 5.4; YITS cycle 5.5: Reading Skills Reassessment.
StatLink http://dx.doi.org/10.1787/888932576833

The same pattern is observed for school factors, as evident in Figure 5.8. For example, those students whose school environment was less supportive showed faster skills growth than those whose school environment was more supportive (63 versus 54 score points). However, performance in PISA-24 was better among those whose school environment was more supportive (612 score points versus 580 score points), as had been the case in PISA-15 (559 versus 517 score points).

■ Figure 5.8 ■

Improvements in reading skills between the ages of 15 and 24, by school-related factors associated with skills at age 15



Source: Table 5.4; YITS cycle 5.5: Reading Skills Reassessment.
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CHAPTER SUMMARY AND CONCLUSIONS

Improvements in reading proficiency between the ages of 15 and 24 occur in environments that are much different from those up until the age of 15. Analysis of PISA-15 and PISA-24 results finds that certain attitudes and learning environments are more beneficial to young people than others in the two different phases of skills growth identified in this exercise. Students who felt they had a high degree of control over their lives did not perform as well at 15 as those who did not share this feeling. Conversely, students who felt they had a more supportive learning environment up to the age of 15 thrived. Yet after the age of 15, things changed: the more supportive early learning environments were associated with slower improvements in reading skills once out of these environments, while a sense of mastery became one of the strongest indicators of improvements in proficiency.

These findings confirm that, over time, skills levels among individuals converge. That is, young people who do not thrive early in their education have opportunities later that may better suit their abilities and preferences. Likewise, students who received extra attention from teachers and parents showed greater improvements in reading proficiency after the age of 15.

Despite the fact that students who performed poorly on PISA at age 15 showed greater improvements in reading proficiency by the time they were 24, the early performance disadvantage was not entirely overcome by age 24. This may partly be because less-proficient students miss out on later education opportunities. The effect of post-secondary education and other life transitions is taken up in the next chapter. The importance of self-determination in improving reading proficiency is also an important factor in these life transitions.

Self determination is key for improvements in proficiency among low-achievers. The degree of control one feels one has over one's life, an individual's sense of mastery, is one of the strongest factors related to improvements in reading skills after the age of 15. In contrast, the sense of self-mastery was negatively related to skills at age 15. From childhood to age 15, the strongest influences on reading proficiency are from parents and the home learning environment, and from teachers and the school learning environment. As individuals transition into adulthood, however, the emphasis shifts to the choices young people make about post-secondary education and the extent to which they practice their reading skills in employment and leisure. Greater autonomy and capacity to make individual life choices is generally related to faster skills growth, particularly when combined with participation in post-secondary education.

Notes

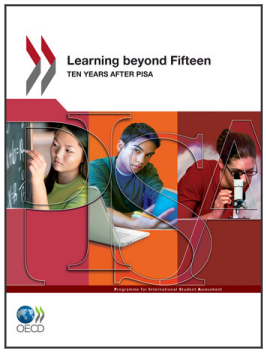
1. Greer, J.V. (1991), and Pearlin, L. and S. Schooler (1978).

2. Statistics Canada (2005), "Youth in Transition Survey 2000, YITS reading cohort, Cycle 1, Users guide", revised September 2005, and provides all the necessary documentation on this variable and is available for download here: *http://www.statcan.gc.ca/imdb-bmdi/document/4435_D25_T1_V1-eng.pdf*

3. This is referred to as the index of "achievement press" in other PISA publications.

4. The index of school supportive environment is constructed as a composite index of student-teacher relations, average sense of belonging, and proportion of language teachers with a specialisation in language instruction. Cartwright and Rhode (2010) provide all details on how this index was constructed.

5. In this context, the analysis focuses on consistency of results across groups. The uncertainty of the estimates is increased by the small sample sizes within each group.



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