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## 6

# Student activities, school practices and collaboration

This chapter considers various student activities that might be related to students' attitudes towards collaboration and their ability to solve problems collaboratively. These factors include students' participation in physical activity and attendance in physical education classes, their out-of-school activities, whether they play truant or arrive late for school, and their attendance at pre-primary school.

### **A note regarding Israel**

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.



The previous chapters examine how demographic factors are related to attitudes towards collaboration and performance in collaborative problem solving. Many of these factors are beyond the direct control of students, teachers or school systems. For example, schools often must accept any student who lives within designated boundaries and they cannot change the gender balance or immigrant population in their student body.

What can be done, then, to improve attitudes towards collaboration and performance in collaborative problem solving? This chapter examines the relationship between both of these outcomes and various student activities and behaviours and school policies and practices, including many of the factors discussed in *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools* (OECD, 2016). As much of the variation in collaborative problem solving performance and in attitudes is found within schools and not between schools (Table V.5.3), the focus will primarily be on student activities and behaviours as most school-level policies and practices are expected to have only a limited relationship with collaboration.

Most of the student demographic factors analysed in Chapter 4 were found not to be unique to performance in collaborative problem solving; they were also observed in student performance in science, reading and mathematics. This chapter thus also attempts to identify those elusive factors that are related to skills specific to collaboration.

### What the data tell us

- Attitudes towards collaboration are generally more positive as students engage in more physical activity or attend more physical education classes per week.
- Students who play video games outside of school score slightly lower in collaborative problem solving than students who do not play video games, on average across OECD countries, after accounting for performance in the three core PISA subjects, gender, and students' and schools' socio-economic profile. On the other hand, students who access the Internet, chat or social networks outside of school score slightly higher than other students.
- Students who work in the household or take care of other family members value both teamwork and relationships more than other students, as do students who meet friends or talk to friends on the phone.
- Students who had attended pre-primary school show more positive attitudes towards collaboration, after accounting for gender and socio-economic status.

## PHYSICAL ACTIVITY

Many studies have tried to discover a link between participation in sports and academic performance, with inconclusive results. For instance, the United States Centers for Disease Control and Prevention (2010) analysed 50 studies showing that physical activity might have a positive, and at least does not have a negative, impact on academic performance. No comprehensive and quantitative studies were found that investigated the relationship between participation in sports and collaborative and co-operative behaviour. However, Pascarella and Smart (1991) found that participation in intercollegiate athletics among men at American colleges was related to both improved leadership skills and social development. There is also some evidence of a relationship between participation in sport and lower antisocial behaviour in adolescents (Mahoney, 2000; Mahoney and Stattin, 2000), increased social functioning in adolescents (Snyder et al., 2010), and increased co-operation among shy children (Findlay and Coplan, 2008).

PISA 2015 asked students to report the number of days during which they engaged in moderate physical activity<sup>1</sup> or vigorous physical activity<sup>2</sup> during the week before the PISA assessment. PISA also asked students how often, on average, they attend physical education class each week during the school year.<sup>3</sup>

On average across OECD countries, students engage in just under five days of moderate physical activity and just under four days of vigorous physical activity in a typical week (Tables V.6.1a and V.6.1b). There is some variation between countries, although students in all countries are, on average, physically active. The average student in Tunisia and the United Arab Emirates engages in moderate physical activity 3.5 times in a typical week (i.e. one out of every two days), while the average student in Denmark, Germany, the Netherlands, Norway and Poland engages in moderate physical activity over 5.5 times in a typical week. Similarly, the average student in Macao (China) engages in vigorous physical activity three times in a typical week, while his or her counterpart in Iceland engages in vigorous physical activity five times a week.



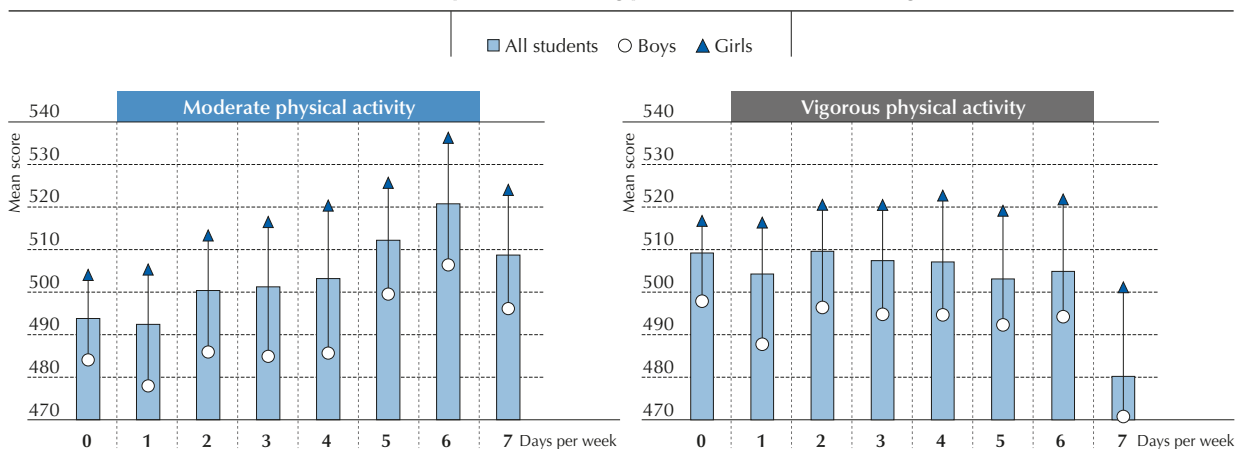
Students attend physical education class twice a week, on average across OECD countries (Table V.6.1c). In Costa Rica, Hong Kong (China) and Ireland, the average student attends physical education class around once a week, while in Hungary and Poland, the average student attends more than three physical education classes per week.

### Performance in collaborative problem solving

There is, on the whole, a positive relationship between the number of days per week that students engage in moderate physical activity during the week prior to the PISA assessment and performance in collaborative problem solving. Students who engage in moderate physical activity two or more days per week score higher in the collaborative problem-solving assessment than students who engage in such activity fewer than two days per week (Figure V.6.1, Table V.6.1a). These trends differ slightly between boys and girls. The better performance among boys is seen only after attaining a threshold of five days of moderate physical activity. The improved performance among girls is observed after attaining a threshold of two days of moderate physical activity and continues to increase with the number of days of physical activity until it peaks at six days per week.

By contrast, students score by and large similarly in collaborative problem solving regardless of the number of days during which they engage in vigorous physical activity, except for those students who engage in these activities every day of the week. On average across OECD countries, these students score 29 points below students who did not engage in any vigorous physical activity during the week prior to the PISA test (among girls, 16 score points separate the two groups; among boys, the gap is 27 points wide) (Figure V.6.1, Tables V.6.1b and V.6.2b).<sup>4</sup>

Figure V.6.1 ■ **Physical exercise and performance in collaborative problem solving, by gender**  
Collaborative problem-solving performance, OECD average



Notes: Moderate physical activities include walking, climbing stairs or riding a bicycle to school for at least 60 minutes per day.

Vigorous physical activities are those that make the student sweat and breathe hard, such as running, cycling, aerobics, soccer or skating, for at least 20 minutes per day.

Source: OECD, PISA 2015 Database, Tables V.6.1a and V.6.1b.

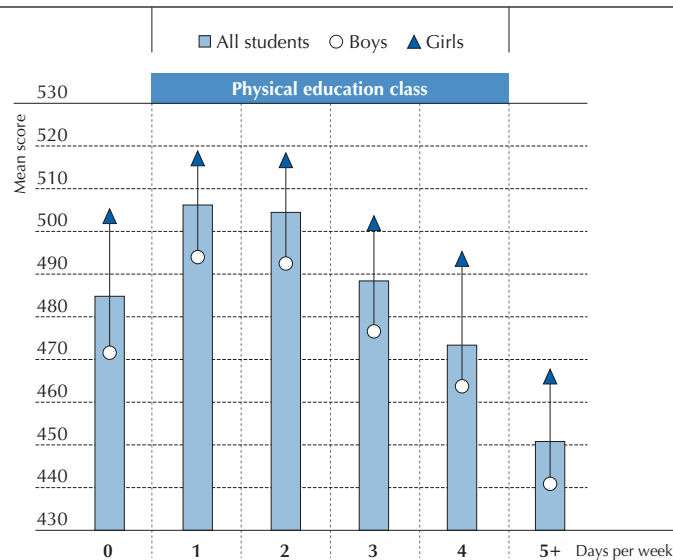
StatLink  <http://dx.doi.org/10.1787/888933616332>

Students who attend one or two days of physical education class per week score highest in collaborative problem solving (Figure V.6.2, Tables V.6.1c and V.6.2c). These students score around 20 score points higher than students who do not attend any physical education class, on average across OECD countries. However, students who participate in four days of physical education class per week score at least 31 points lower in collaborative problem solving than those who take part in one or two classes per week, and 10 points lower than those who do not take part in any physical education classes. Students who participate in five days of physical education class per week score around 55 points lower than those who take part in one or two classes per week, and 33 points below those who do not take part in any physical education classes. Similar trends are observed among boys and girls.

However, performance in the three core PISA subjects of science, reading and mathematics follows similar patterns with respect to the frequency of physical activity and attendance at physical education classes. To what extent are these performance differences attributable to general cognitive performance, and to what extent are they representative of true differences in collaboration and interpersonal skills?



Figure V.6.2 ■ **Physical education class and performance in collaborative problem solving, by gender**  
*Collaborative problem-solving performance, OECD average*



Source: OECD, PISA 2015 Database, Table V.6.1c.

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After accounting for performance in science, reading and mathematics, there are few significant differences in performance on the collaborative problem-solving assessment related to the number of days in an average week during which a student engages in moderate physical activity (Table V.6.3a). Any significant differences observed on average across OECD countries are not consistently observed across individual countries and economies. However, additional days of vigorous physical activity beyond two days per week are associated with successively lower relative performance scores in collaborative problem solving (after accounting for performance in the three core PISA subjects) (Table V.6.3b).

Most differences in relative performance associated with the number of days that a student attends physical education class per week are not significant across OECD countries. The greatest differences are found among students who attend four or five days of physical education class per week, who score over five points lower in collaborative problem solving than students who attend fewer days of physical education class per week, but who have similar scores in science, reading and mathematics (Table V.6.3c). In other words, students' collaboration-specific skills are observed to decrease above a certain threshold of vigorous physical activity or attendance in physical education classes.

### Attitudes towards collaboration

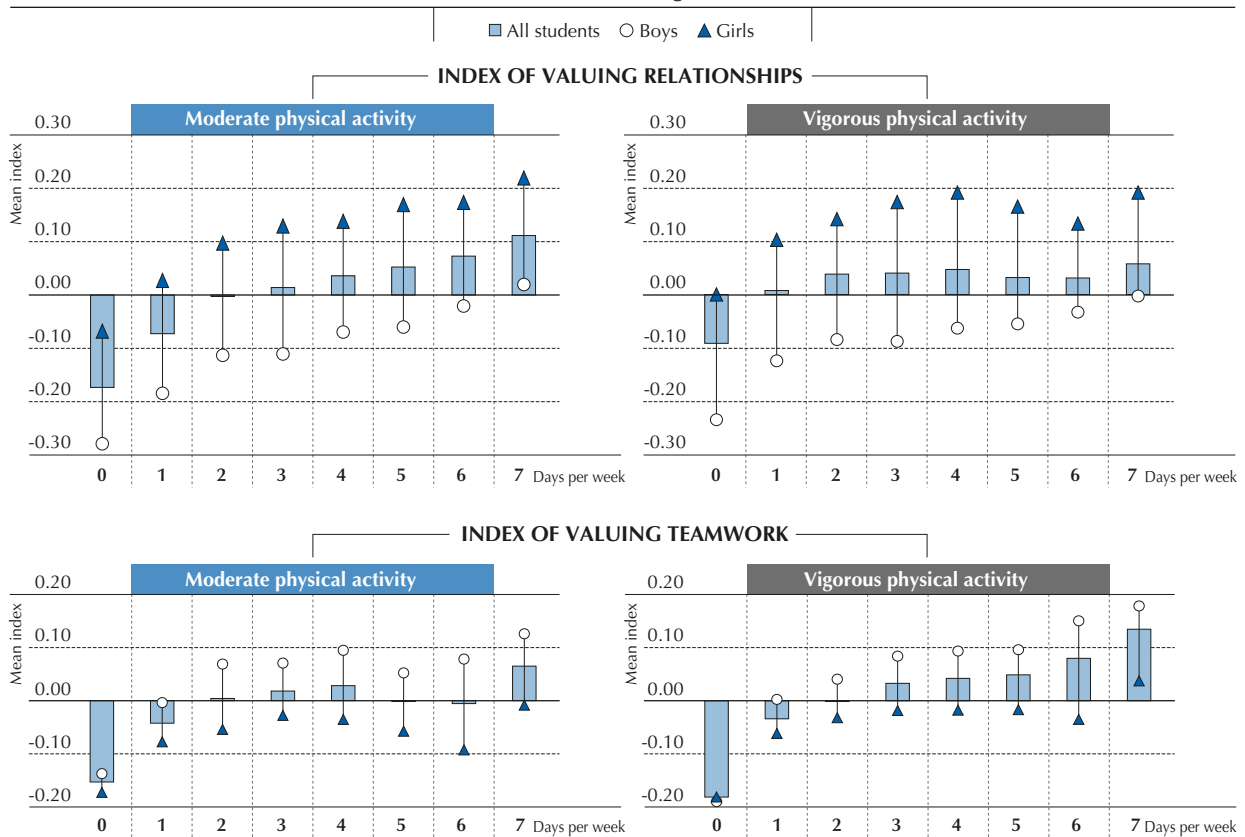
Students who participate in moderate or vigorous physical activity more often during the week tend to have more positive attitudes towards collaboration, as shown in Figures V.6.3 and V.6.4. The index of valuing relationships seems to increase progressively as students engage in more days of moderate physical activity. It increases up to a threshold of two days per week of vigorous physical activity, after which it remains relatively constant.<sup>5</sup>

There is also a continuous increase in the index of valuing teamwork with the number of days that students engage in vigorous physical activity. Students who do not engage in any vigorous physical activity during an average week are almost one-third of a standard deviation lower on that index than students who engage in vigorous physical activity every day of the week (Table V.6.4b). The relationship with moderate physical activity is less clear-cut. There appears to be a general increase in the index of valuing teamwork as students engage more frequently in moderate physical activity, although the trend is not monotonic.

The index of valuing teamwork increases progressively with the number of days of physical education class that students attend. On average across OECD countries, students who attend physical education class every day of the school week have an index of valuing teamwork 0.23 unit higher than students who do not attend any physical education class (Figure V.6.4). The index of valuing relationships, however, is highest among those students who participate in physical education class one or two days per week.



Figure V.6.3 ■ Physical exercise and attitudes towards co-operation, by gender  
OECD average

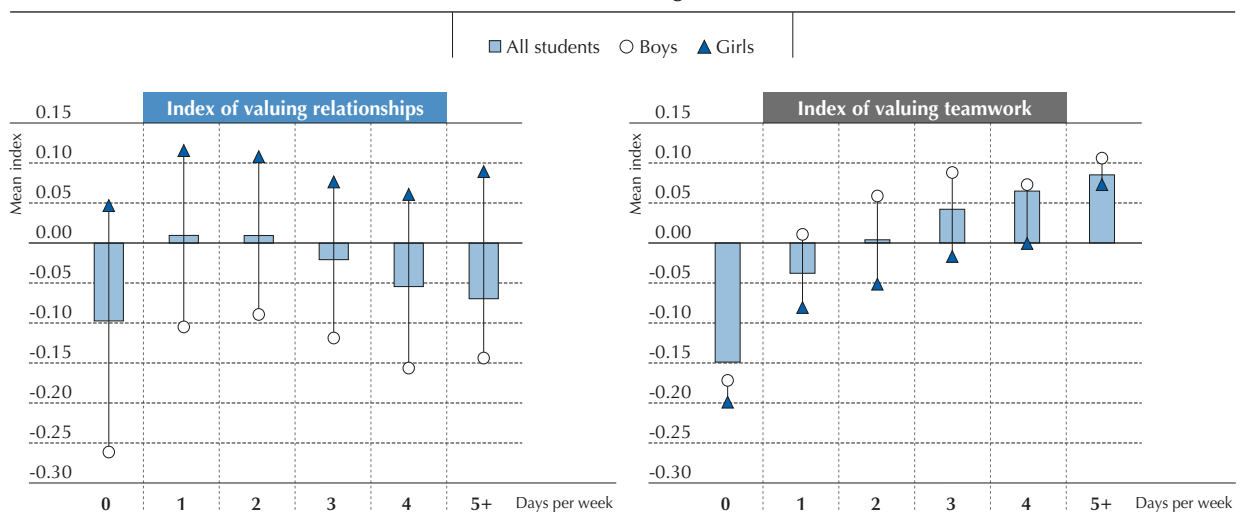


Notes: Moderate physical activities include walking, climbing stairs or riding a bicycle to school for at least 60 minutes per day. Vigorous physical activities are those that make the student sweat and breathe hard, such as running, cycling, aerobics, soccer or skating, for at least 20 minutes per day.

Source: OECD, PISA 2015 Database, Tables V.6.4a and V.6.4b.

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Figure V.6.4 ■ Physical education class and attitudes towards co-operation, by gender  
OECD average



Source: OECD, PISA 2015 Database, Table V.6.4c.

StatLink <http://dx.doi.org/10.1787/888933616389>



Students were not asked whether they participate in individual or team sports, a factor that affects the interpretation of these results. Caution is also advised when comparing results that involve different measures of physical activity and exercise. Physical education class in school might be voluntary or obligatory. PISA did not ask students how long their physical education classes lasted, so some students might have had fewer days of longer physical education classes, while other students might have had more days of shorter physical education classes. Moderate or vigorous physical activity includes exercise and sport in which students participate both during and outside of school hours. Hence, the various measures of physical activity are neither necessarily interchangeable nor comparable.

## STUDENT ACTIVITIES OUTSIDE OF SCHOOL

PISA 2015 asked students whether they participated in a variety of activities before or after school on the most recent school day prior to sitting the PISA assessment. Several of these activities might have a social – or perhaps antisocial – component to them: using the Internet/chat/social networks; playing video games; meeting friends or talking to friends on the phone; and working in the household or taking care of family members.

These questions measure what occurs on only one particular school day and may not accurately describe a student's general level of participation in any of these activities. However, the four activities described above generally require minimal dedicated effort – they can be performed at home, without having to go to a special location – and hence are likely to be performed on a regular, almost daily basis by those who partake in them. Hence, asking students whether they participated in these activities on the most recent school day is likely to elicit responses that show whether they participate in these activities on most school days.<sup>6</sup>

## Performance in collaborative problem solving

### *Playing video games*

On average across OECD countries, a negative association is observed between performance in collaborative problem solving and playing video games. Students who play video games score 32 points lower, on average, than students who do not play video games (Figure V.6.5). This gap is also significant and in favour of those who do not play video games in 50 out of the 51 participating countries and economies; it is largest in Israel and the United Arab Emirates, where students who play video games score 58 points in collaborative problem solving below students who do not play video games. Only in Costa Rica is there a non-significant gap between these two groups of students (Table V.6.7b).

This gap remains significant after accounting for performance in science, reading and mathematics. The relative score of students who play video games outside of school is 15 points below that of students who do not play video games, on average across OECD countries; after also accounting for gender and students' and schools' socio-economic profile, the gap is still significant but only 4 score points wide (Figure V.6.5, Table V.6.7b). The fall in collaborative problem-solving performance associated with playing video games is particularly large in Israel, Thailand and the United States, where it is over 10 score points (after also accounting for gender and students' and schools' socio-economic profile).

The reduction of the performance gap in collaborative problem-solving between students who play and those who do not play video games, after accounting for performance in the three core PISA subjects, can be largely attributed to cognitive aspects common to all four assessments. Likewise, boys play video games more often than girls and boys perform worse in collaborative problem solving; accounting for gender thus narrows the performance gap. However, the gap still remains significant after accounting for all of these variables, which indicates that there are still unexplained factors that might be behind this relationship.

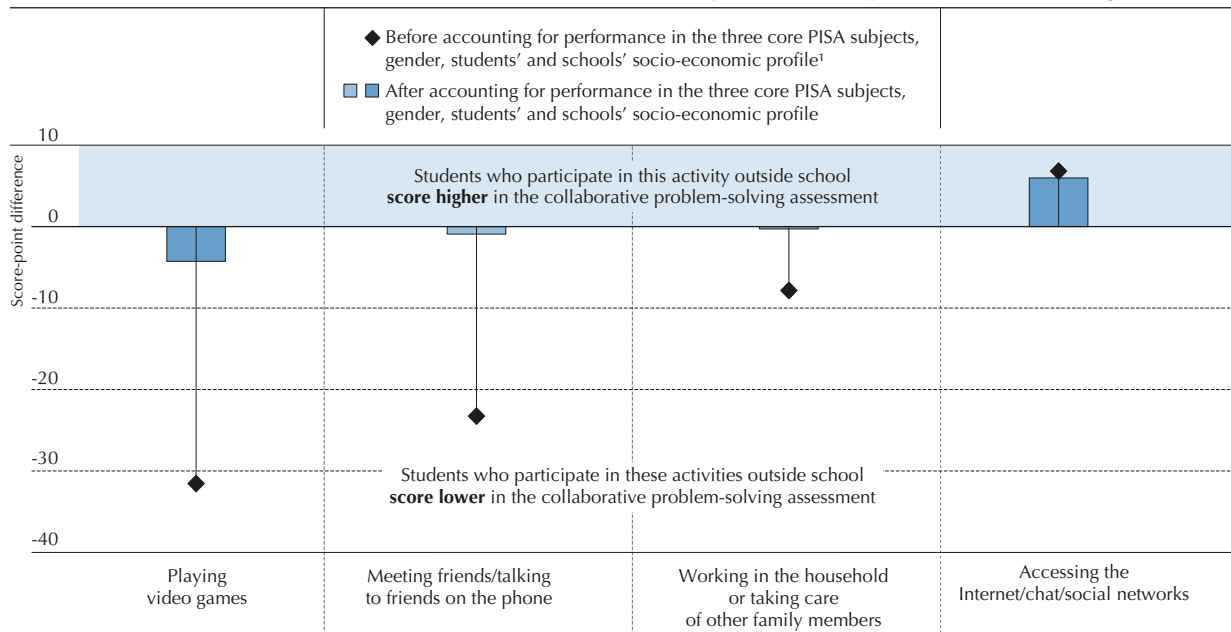
### *Accessing the Internet, chat or social networks*

By contrast, accessing the Internet, chat, or social networks outside of school is associated with higher performance in collaborative problem solving. On average across OECD countries, students who access such online communication media score seven points above students who did not in the collaborative problem-solving assessment (Figure V.6.5). At the country level, the gap is significant and in favour of students who accessed such media in 23 of the 51 countries and economies, and is over 35 score points wide in Brazil, Colombia and Norway. In six countries and economies, the gap is significant but in favour of students who did not access such media, with the widest such gap – 35 score points – observed in the United States (Table V.6.7a).

After accounting for performance in science, reading and mathematics, gender, and students' and schools' socio-economic status, a significant gap of six score points in collaborative problem-solving performance is still observed across OECD countries in favour of students who had accessed the Internet, chat, or social networks outside of school (Figure V.6.5).



Figure V.6.5 ■ **Activities outside of school and performance in collaborative problem solving**  
*Difference in collaborative problem-solving performance between students who reported that they had engaged in these activities before or after school and those who reported that they had not, OECD average*



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

**Notes:** Score-point differences that are statistically significant are shown in a darker tone. All differences before accounting for performance in the three core PISA subjects, gender, and students' and schools' socio-economic profile are statistically significant (see Annex A3).

Students were asked whether they had engaged in these activities before or after school on the most recent school day prior to the PISA assessment.

Activities are ranked in ascending order of the score-point difference in collaborative problem solving, after accounting for performance in the core PISA subjects, gender, and students' and schools' socio-economic profile.

Source: OECD, PISA 2015 Database, Tables V.6.7a-d.

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This gap is significant and in favour of students who had accessed such media in 13 of the 51 participating countries and economies, and is over 15 points wide in the Czech Republic and Germany. By contrast, the performance gap is significant and in favour of students who had not accessed such media only in the United States, where it is 10 score points wide (Table V.6.7a).

These forms of media are all accessed via the computer or another form of information and communications technology (ICT), much in the same way that the PISA 2015 collaborative problem-solving assessment was conducted. Hence, students who participate in these activities outside of school might already be more familiar with the idea of and have more experience in interacting with others in a virtual environment. Accessing these forms of media may also be relevant to how students might collaborate virtually after they leave school.

### Other out-of-school activities

Students who met friends or talked to friends on the phone performed below students who did neither in the collaborative problem-solving assessment. Likewise, students who worked in the household or took care of family members performed worse in collaborative problem solving than students who did not do so. However, after accounting for performance in science, reading and mathematics, gender, and students' and schools' socio-economic status, no significant difference in performance between the groups of students remained (Figure V.6.5).

## Attitudes towards collaboration

### Meeting friends or talking to friends on the phone, and accessing the Internet, chat or social networks

Participation in each of the activities described above is associated with a significant change in students' attitudes towards collaboration. First, students who met friends or talked to friends on the phone outside of school are located higher on the index of valuing relationships (by 0.07 unit after accounting for gender and socio-economic status, on average across OECD countries) and much higher on the index of valuing teamwork (by 0.29 unit after accounting for gender and socio-economic status, on average across OECD countries) than students who did not do so (Table V.6.8a).



Indeed, the index of valuing teamwork was higher among students who met friends or talked to friends outside of school in 54 out of the 57 countries that administered the PISA assessment on the computer.

Students who met friends or talked to friends on the phone outside of school were particularly more likely to report that they prefer working as part of a team to working alone (11 percentage-point difference, after accounting for gender and socio-economic status); that they find that teamwork raises their own efficiency (11 percentage-point difference); and that they enjoy co-operating with peers (9 percentage-point difference). The largest gaps are found in the Russian Federation (hereafter “Russia”), where students who met friends or talked to friends on the phone outside of school were 22 percentage points more likely to report that they prefer working as part of a team; 19 percentage points more likely to report that they find that teamwork improves their own efficiency; and 19 percentage points more likely to report that they enjoy co-operating with peers (Table V.6.8a).

Similar results are observed for students who access the Internet, chat or social networks outside of school. After accounting for gender and socio-economic status, these students have an index of valuing teamwork 0.19 unit higher than students who do not access such communications media, on average across OECD countries, although their index of valuing relationships is a relatively small 0.02 unit below that of students who do not access such communications media (Table V.6.8b).

As with meeting friends or talking to friends on the phone, students who access the Internet, chat or social networks outside of school are also significantly more likely to say that they prefer working as part of a team to working alone (by 8 percentage points); that they enjoy co-operating with peers (by 8 percentage points); and that they find that teamwork raises their own efficiency (by 7 percentage points) (Table V.6.8b).

Meeting friends, talking to friends on the phone, and using the Internet, chat or social networks are all ways to develop and nurture relationships with others. It might therefore seem surprising that these activities are associated with a greater difference in how students value teamwork compared to how they value relationships. However, the relationships are not causal and an explanation for these relationships cannot be ascertained from data from PISA.

### ***Working in the household and taking care of family members***

Students who work in the household or who take care of family members value both relationships and teamwork more than students who do not engage in these activities. On average across OECD countries, these students are 0.19 unit higher on the index of valuing relationships and 0.16 unit higher on the index of valuing teamwork than other students, after accounting for gender and students’ and schools’ socio-economic profile. Moreover, a significant difference is observed in almost every country and economy that administered the PISA 2015 assessment on the computer. Students in Latvia, Lithuania and New Zealand were particularly more likely to value both relationships and teamwork if they work in the household or take care of family members (Table V.6.8d).

As mentioned earlier, it is impossible to determine causality, if a causal relationship between the variables exists. Students who value relationships and teamwork might be more likely to help out around the house. However, it might also be that students who, out of necessity, help out around the house develop an appreciation of the interpersonal relationships and teamwork required to make a family work successfully.

### ***Playing video games***

Playing video games is also associated with students’ attitudes towards teamwork. On average across OECD countries, and after accounting for gender and students’ and schools’ socio-economic profile, students who play video games outside of school have a higher index of valuing teamwork than students who do not play video games (a 0.04-unit gap), with students in Bulgaria, Hungary, Italy, Portugal and the United Arab Emirates particularly more likely to value teamwork (a gap of over 0.10 unit). Many video games, especially multiplayer games where players in different physical locations connect to a network, require players to work together on the same team towards the same goal. This may develop or require positive dispositions towards teamwork.

However, students who play video games have a lower index of valuing relationships (a 0.05-unit gap), on average, than other students. Students in Greece, Iceland, Lithuania, Montenegro, Norway, Peru, Spain, Switzerland and Turkey were particularly less likely to value relationships (a gap of over 0.10 in the index). Meaningful relationships with others are not necessarily fostered in video games, where players often interact through virtual avatars and not face-to-face with others (Table V.6.8c).





## STUDENT TRUANCY

Students may play truant from school or be late for school for a variety of reasons, including a lack of motivation, interest or desire to be in school (Allen-Meares, Washington and Walsh, 2000; Read, 1983), poor enforcement of disciplinary penalties for truancy (Epstein and Sheldon, 2002), poor academic performance (Henry, 2007; Strickland, 1998) or because they do not enjoy spending time with their classmates or in the school environment (Buist, 1980; Croft and Grygier, 1956; Nielsen and Gerber, 1979). Truancy and lateness may be manifestations of the rejection of this stable environment, where students learn subject matter, develop cognitive skills, and nurture friendships and relationships with others.

In particular, Reid (1984) found that Welsh students who often played truant from school displayed neurotic and antisocial behaviour to a larger extent than students who did not skip school. A similar study in Canada showed lower levels of social competence and higher levels of antisocial behaviour among truant students (Corville-Smith et al., 1998). Are similar results observed across many schools and across countries and economies in the PISA 2015 collaborative problem-solving assessment?

### Performance in collaborative problem solving

On average across OECD countries, students who had skipped a whole day of school in the two weeks prior to the PISA test score 39 points below those who had not skipped a whole day of school in collaborative problem solving (Table V.6.9a). The difference is particularly stark in Beijing-Shanghai-Jiangsu-Guangdong (China) (hereafter “B-S-J-G [China]”), Japan, Korea, Slovenia and Chinese Taipei, where it exceeds 65 score points. In four of these countries and economies, fewer than one in 30 students had skipped a whole day of school at least once in the two weeks prior to the PISA assessment. In no country/economy do students who had skipped a whole day of school during that period perform better on the collaborative problem-solving assessment than students who had not.

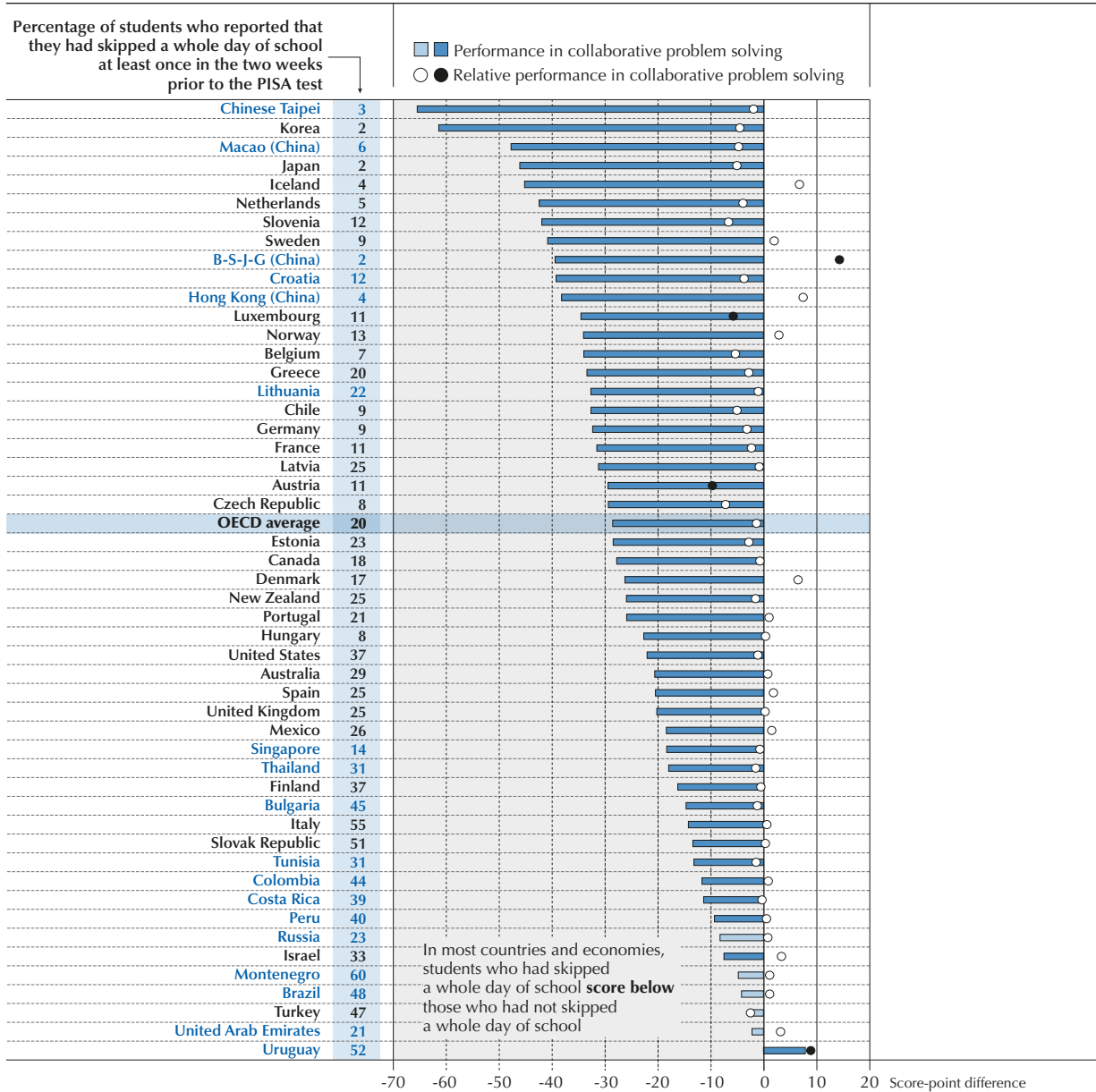
The performance gap remains after accounting for gender, and students’ and schools’ socio-economic profile. Students who had skipped a whole day of school score 29 points below students who had not after accounting for these factors (Figure V.6.6), on average across OECD countries. Similar differences are observed among students who had skipped at least one class in those two weeks (a gap of 29 score points before accounting for gender, and students’ and schools’ socio-economic profile; a 24 score-point gap after accounting for those factors) and among students who had arrived late for school (a 24 score-point gap before accounting for those factors; an 18 score-point gap after accounting for them) (Table V.6.9b and Table V.6.9c).

However, *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools* (OECD, 2016) notes that students who had played truant from school also score lower in the science assessment. Given the relationship between collaborative problem-solving performance and performance in the three core PISA domains, is there any relationship between student truancy and lateness, and the distinctive aspects of collaborative problem solving?

The significant relationships described are not observed after accounting for student performance in science, reading and mathematics, gender, and students’ and schools’ socio-economic profile: there is no longer any difference in collaborative problem-solving performance between students who had and those who had not skipped a whole day of school, skipped some classes or arrived late for school when these two groups of students perform at similar levels in science, reading and mathematics (Tables V.6.9a, V.6.9b and V.6.9c). Only in Austria and Luxembourg do students who had skipped a whole day of school in the two weeks prior to the PISA assessment perform worse in collaborative problem solving (by 6 and 10 score points, respectively), after accounting for their performance in the three core PISA domains, gender, and students’ and schools’ socio-economic profile. By contrast, in Uruguay, students who had skipped a whole day of school score 9 points higher, and in B-S-J-G (China), they score 14 points higher than those students who had not.

It therefore appears that there is no association between student truancy and lateness, and the distinctive aspects of collaborative problem solving. This may lend support to the hypothesis that students choose to play truant from school because of factors related to their academic performance and how they view school itself, as opposed to their ability to collaborate with classmates.<sup>7</sup> It could also be that the antisocial behaviour and poor social competence observed by Read (1984) and Corville-Smith et al. (1998) are consequences of other factors that also lead to increased truancy.

Figure V.6.6 ■ **Skipping a whole day of school and performance in collaborative problem solving**  
 Difference in performance between students who had skipped a whole day of school in the two weeks prior to the PISA test and those who had not, after accounting for gender, and students' and schools' socio-economic profile<sup>1</sup>



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Notes: Statistically significant differences are shown in a darker tone (see Annex A3).

Relative performance refers to the residual performance, attributable to purely "collaborative problem-solving" competencies, after accounting for performance in science, reading and mathematics in a regression performed across students nationally.

Countries and economies are ranked in ascending order of the score-point difference in collaborative problem-solving performance, after accounting for gender, and students' and schools' socio-economic profile.

Source: OECD, PISA 2015 Database, Table V.6.9a.

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## Attitudes towards collaboration

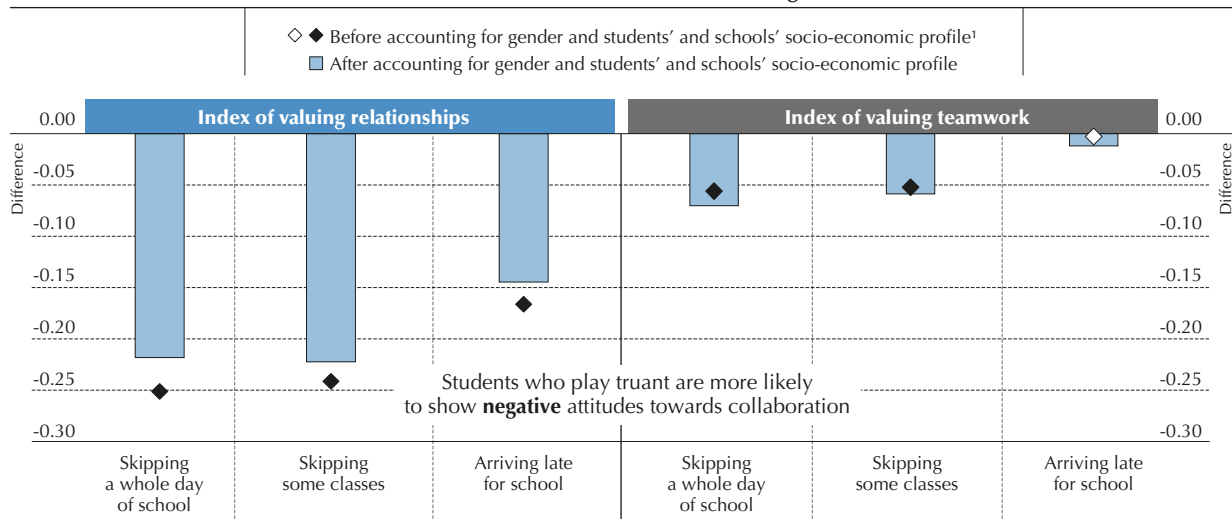
Students who play truant or arrive late for school are also less likely to have positive attitudes towards collaboration. On average across OECD countries, students who had skipped at least one day of school or had skipped some classes in the two weeks prior to sitting the PISA assessment have significantly lower values on both the index of valuing relationships and the index of valuing teamwork. Students who had arrived late for school have a lower index of valuing relationships,



but there is no difference observed in the index of valuing teamwork. After accounting for gender, and students' and schools' socio-economic profile, students who play truant or arrive late for school have lower indices of both valuing relationships and valuing teamwork (Figure V.6.7).

For example, in 53 of 56 countries and economies, students who had skipped at least one full day of school are located significantly lower on the index of valuing relationships than students who had not done so (Table V.6.10a). Differences between these two groups of students are especially large in Croatia, Iceland and Switzerland. After accounting for gender, and students' and schools' socio-economic profile, differences are still significant in 51 out of 56 countries and economies.

Figure V.6.7 ■ **Skipping a whole day of school and attitudes towards collaboration**  
Change in the index when students reported the following having taken place during the two weeks prior to the PISA assessment, OECD average



1. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Note: Statistically significant differences are shown in a darker tone. All differences for after accounting for gender and students' and schools' socio-economic profile are statistically significant (see Annex A3).

Source: OECD, PISA 2015 Database, Tables V.6.10a-c.

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The largest gaps in attitudes are observed for the statements "I am a good listener", "I enjoy seeing my classmates be successful", and "I take into account what others are interested in". On average across OECD countries, students who had skipped at least one whole day of school in the two weeks prior to the PISA assessment were over six percentage points less likely to agree or strongly agree with each of these items than students who had not done so, after accounting for gender and socio-economic profile. The gaps are particularly striking in Iceland, the Netherlands and Sweden, where they are over 9 percentage points for all three of these statements after accounting for gender and socio-economic profile (Table V.6.10a).

The largest gaps in attitudes towards collaboration are seen when considering the statements that are included in the index of valuing relationships, which are closely related to valuing others' opinions and success. It thus appears that there is a particularly strong relationship between the decision to play truant and the extent to which a student values friendships and other interpersonal relationships. This is not necessarily surprising, given that students who play truant have less time to develop such relationships and might not be as integrated into the school environment as other students.

Is there a relationship between the behaviour of a truant student and the attitudes of his or her non-truant classmates? Tables V.6.11a, V.6.11b, and V.6.11c show that, on average across OECD countries, students who had not played truant or who had not arrived late for school had lower indices of enjoying and valuing co-operation when they attended schools where more of their classmates were truant or late for school, after accounting for gender, and students' and schools' socio-economic profile. This negative association is also observed for almost all of the individual statements.<sup>8</sup>



In particular, the attitudes towards collaboration of students in Belgium, Lithuania and Qatar who had not played truant – they had not skipped a day of school, skipped any classes, nor had arrived late for school in the two weeks prior to the PISA assessment – were more negative when the students attend schools where more of their classmates had been truant after accounting for gender and students' and schools' socio-economic profile.

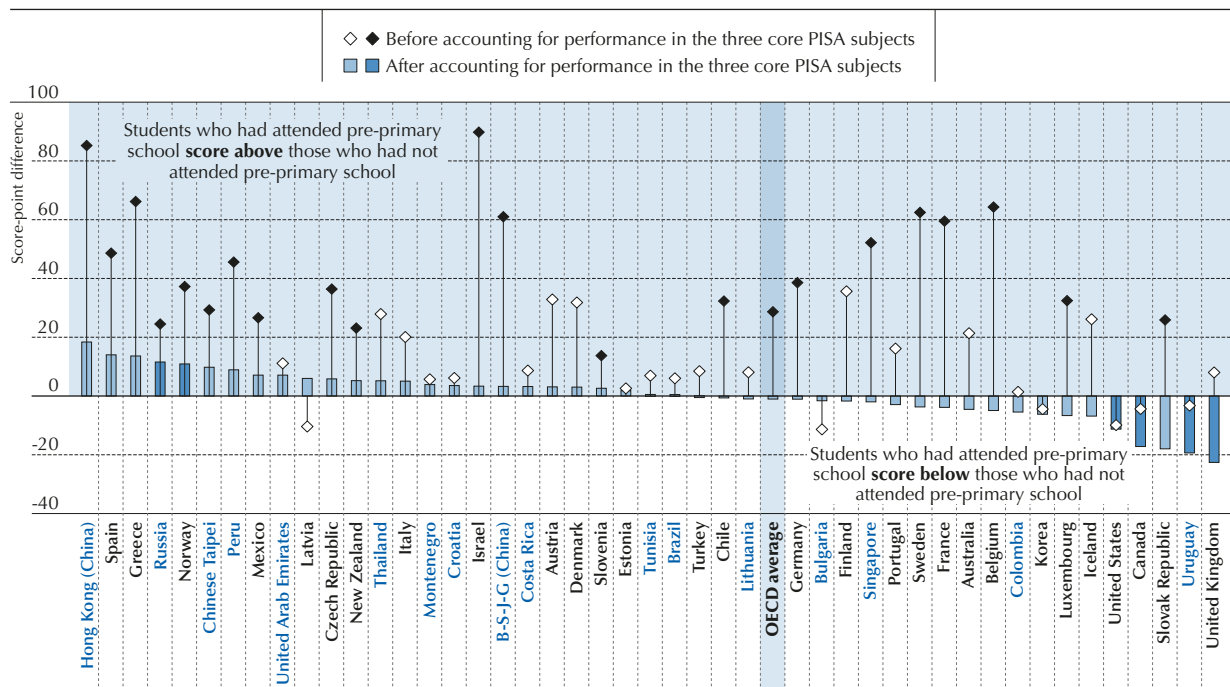
## ATTENDANCE AT PRE-PRIMARY SCHOOL

### Performance in collaborative problem solving

Parents often enrol their children in pre-primary school so that they can go back to work, so that their children can develop cognitive skills, and most relevant to collaboration, so that their children can begin the socialisation process before primary school. For example, parents expect their children to learn how to behave with others outside of the family, communicate, share, express themselves and observe social rules governing interpersonal interaction (Currie and Almond, 2011; Sollars, 2017; Williams, Sheridan and Sandberg, 2014). Indeed, many pre-primary schools focus on developing both empathy (Jalongo, 2013) and social skills (Ostrosky and Meadan, 2010). Does pre-primary school prepare children to collaborate and co-operate? Is the difference between those who had attended pre-primary school and those who had not still apparent ten years later, when students are 15 years old and at the age when they sit the PISA assessment?

Some 95% of 15-year-old students, on average across OECD countries, had attended some form of pre-primary school.<sup>9</sup> Results from the PISA 2015 collaborative problem-solving assessment and student questionnaire show that students who had attended pre-primary school score 29 points higher than students who had not attended pre-primary school. A significant difference is observed in 21 of the 47 countries for which data are available (Table V.6.12a). In four countries where at least 5% of 15-year-olds had not attended pre-primary school<sup>10</sup> – B-S-J-G (China), Norway, Russia and Slovenia – students who had attended pre-primary school score significantly higher in collaborative problem solving than those students who had not (Figure V.6.8). In no country or economy is the gap significant in favour of students who had not attended pre-primary school.

Figure V.6.8 ■ **Pre-primary school and performance in collaborative problem solving**  
Difference in collaborative problem-solving performance between students who had attended pre-primary school and those who had not



Note: Statistically significant score-point differences are shown in a darker tone (see Annex A3).

Countries and economies are ranked in descending order of the score-point difference in collaborative problem-solving performance, after accounting for the three core PISA subjects.

Source: OECD, PISA 2015 Database, Table V.6.12a.

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However, this difference vanishes after accounting for student performance in science, reading and mathematics (Figure V.6.8), whether or not gender, and students' and schools' socio-economic profile are also accounted for. On average across OECD countries, there is no significant relationship between attendance at pre-primary school and the distinctive aspects of collaborative problem solving, indicating that the performance gap described above reflects the relationship between collaborative problem-solving performance and performance in science, reading and mathematics. Attendance at pre-primary school has no discernible effect on the unique aspects of collaborative problem solving (or what one would attribute to collaboration skills as opposed to general academic proficiency) ten years later.

In fact, after accounting for performance in the three core PISA subjects, a significant advantage in collaborative problem-solving performance among students who had attended pre-primary school is observed only in Norway (11 score points) and Russia (12 score points), while a significant disadvantage among students who had attended pre-primary school is found, among countries where at least 5% of 15-year-olds had not attended pre-primary school, in the United States (11 score points) (Figure V.6.8).

Different students might also gain different skills and advantages from attending pre-primary school. While advantaged families might be able to provide their children with similar learning and socialisation opportunities even if they do not attend pre-primary school, disadvantaged families might have a harder time preparing their children in the first few years of life without the help, support and structure of some form of a pre-primary school arrangement. In other words, the difference in outcomes associated with pre-primary school might differ between advantaged and disadvantaged families (Crampton and Hall, 2017; Havnes and Mogstad, 2011; Leseman, 2002; OECD, 2011; Sylva et al., 2010).<sup>11</sup>

On average across OECD countries, some 93% of disadvantaged<sup>12</sup> students and 97% of advantaged<sup>13</sup> students had attended some form of pre-primary education. However, on average across OECD countries, students from advantaged families appear to gain more from attendance at pre-primary school (a gap of 14 score points) than students from disadvantaged families (a gap of 9 score points) when it comes to performance in collaborative problem solving (Table V.6.12b). This gap becomes insignificant for both types of families after accounting for performance in science, reading and mathematics. Once again, this indicates that attendance at pre-primary school has no relationship with the distinctly collaborative aspects of problem solving when assessed ten years later – among both advantaged and disadvantaged students.

### Attitudes towards collaboration

On average across OECD countries and after accounting for gender, and students' and schools' socio-economic profile, students who had attended pre-primary school have significantly higher values on the indices of valuing relationships and teamwork and were more likely to agree or strongly agree with all of the items that comprise these two indices (Table V.6.13). However, on average across OECD countries, less than 5% of students reported that they had not attended pre-primary school (Table V.6.12a). As a result, in most countries and economies, the standard errors of effects related to pre-primary school are large and these effects are not significant.

For example, after accounting for gender, and students' and schools' socio-economic profile, only in Chile and Finland do students who had attended pre-primary school have a higher mean index of valuing relationships, while in Australia, Lithuania, Qatar, Slovenia and Turkey, these students have a lower mean index of valuing relationships. Likewise, in only 17 of the 55 countries that took part in the student questionnaire and for which data are available do students who had attended pre-primary school have a higher mean index of valuing teamwork (Table V.6.13).

Students who had attended pre-primary school were between two and five percentage points more likely than those who had not attended to agree or strongly agree with each of the statements that are related to attitudes towards collaboration, after accounting for gender, and students' and schools' socio-economic profile. For instance, they were 4.7 percentage points more likely to agree that they "prefer working as part of a team to working alone", a gap that widens to over 15 percentage points in the Czech Republic and France. They were also 4.0 percentage points more likely to agree that they "take into account what others are interested in", a gap that grows to over 12 percentage points in the Czech Republic, Germany and Luxembourg. However, in 19 of the 52 countries that took part in the computer-based assessment and for which data are available, there is no significant difference between students who had and those who had not attended pre-primary school in their responses to all of the individual items regarding attitudes towards collaboration.

Thus, attendance at pre-primary school is positively correlated with positive attitudes towards collaboration, and while attendance at pre-primary school is also positively correlated with performance in collaborative problem solving,



this relationship disappears once performance in science, reading and mathematics is accounted for. These results provide some support to the idea that pre-primary schools develop socialisation skills (through the development of cognitive skills) and positive attitudes towards co-operating with others that can have a lasting impact.

## STUDENT INTERACTION IN SCIENCE CLASS

### Performance in collaborative problem solving

The PISA 2015 student questionnaire asked students about how often certain activities occur during science class. Four of these activities were identified as being communication-intensive: explaining one's ideas in science class; spending time in the laboratory doing practical experiments; arguing about science questions; and taking part in class debates about investigations.

A significant negative relationship is observed between performance in the PISA 2015 collaborative problem-solving assessment and three of these activities in science class. Students who spend time in the laboratory doing practical experiments or who debate about investigations in most or all lessons score 31 points lower in collaborative problem solving than students who did so in some lessons, hardly ever or never. Similarly, they scored 23 points lower if they argue about science questions in most or all lessons (Tables V.6.14b-d). These relationships are still significant after accounting for performance in science, reading and mathematics, gender, and students' and schools' socio-economic status, although the gap shrinks to between three and four score points.

In Brazil, B-S-J-G (China), Colombia, Israel, Japan, Luxembourg, Mexico, Montenegro, Singapore, Tunisia and Uruguay, student performance in collaborative problem is lower whenever students participated in any one of these three activities in most or all science lessons, even after accounting for performance in the three core PISA subjects, gender, and students' and schools' socio-economic status (Tables V.6.14b-d).

As in all the correlations examined in this chapter, no causal relationship is claimed. Students' performance in collaborative problem solving might be influenced by the pedagogical strategies used by their teachers; but teachers might also choose certain teaching methods over others based on their students' behaviour and capabilities.

No significant relationship is observed between performance in collaborative problem solving and the fourth communication-intensive activity in science class – explaining one's ideas – after accounting for performance in the three core PISA subjects, gender, and socio-economic status (Table V.6.14a).

### Attitudes towards collaboration

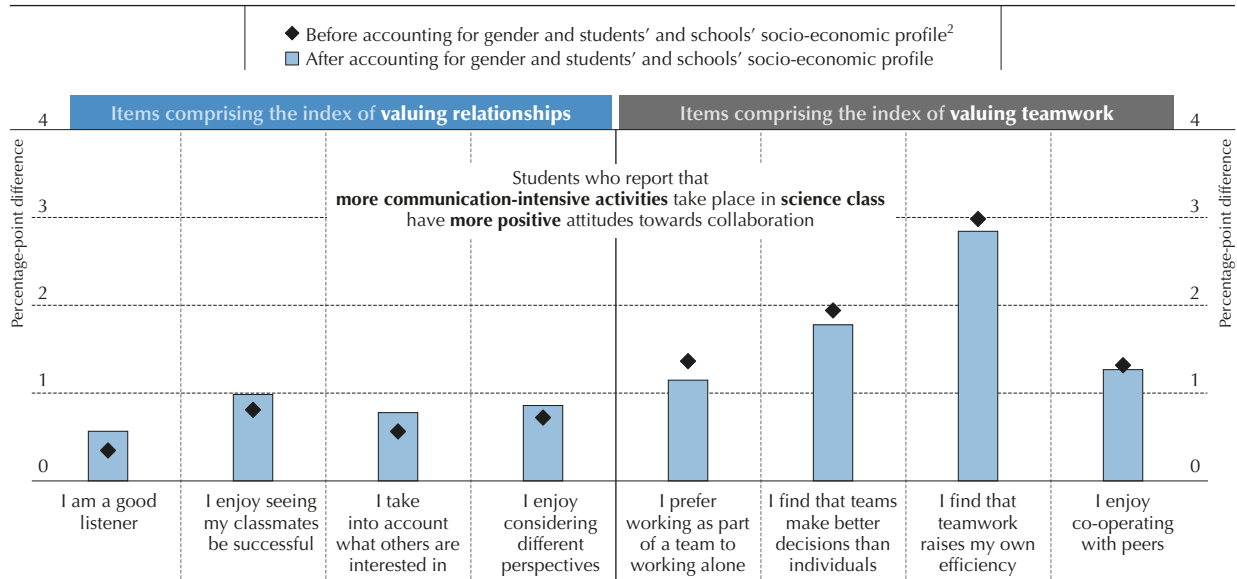
Significant relationships between these activities and attitudes towards collaboration are observed both on average across OECD countries and in many countries and economies. On average across OECD countries, the indices of valuing relationships and teamwork are higher among students who reported that they participate in these activities in most or all lessons than among those who reported that they participate in these activities in only some lessons or never/hardly ever (Tables V.6.15a-d).

Students who are given opportunities to explain their ideas in most or all lessons were two to six percentage points more likely to agree or strongly agree with each of the statements regarding attitudes towards collaboration. This difference is observed in most countries and economies. For example, after accounting for gender, and students' and schools' socio-economic profile, in 46 of the 56 countries and economies that administered the student questionnaire on computer, students who reported that they explain their ideas in most or all science lessons were more likely to agree that they are "a good listener"; in 37 out of 56 countries and economies, these students also agreed that they "enjoy considering different perspectives". Only in Brazil were students who reported that they explain their ideas in most or all lessons less likely to agree or strongly agree that they "enjoy considering different perspectives".

The index of student interaction in science class was created by combining student responses to how often the four communication-intensive activities described above take place. It is equal to the number of statements describing activities in which students reported that they participate during most or all lessons. Students are more likely to agree or strongly agree with each of the statements related to collaboration as they interact more in science class. The largest effects are observed for the statement "I find that teamwork raises my own efficiency". On average across OECD countries, students are 2.8 percentage points more likely to agree or strongly agree with this statement than students who do not participate in these activities for every additional communication-intensive activity in which they participate in science class, after accounting for gender, and students' and schools' socio-economic profile (Figure V.6.9).



Figure V.6.9 ■ **Student interaction in science class and attitudes towards collaboration**  
*Change in the percentage of students who agree/strongly agree with the following statements per one-unit increase in the index of student interaction in science class<sup>1</sup>, OECD average*



1. The index of student interaction in science class is the sum of students' responses to questions about whether their science teachers use the following teaching practices in all lessons or in most lessons: students are given opportunities to explain their ideas; students spend time in the laboratory carrying out practical experiments; students are required to argue about science questions; there is a class debate about investigations. The index ranges from 0 to 4, with all responses weighted equally.

2. The socio-economic profile is measured by the PISA index of economic, social and cultural status (ESCS).

Note: All differences are statistically significant (see Annex A3).

Source: OECD, PISA 2015 Database, Table V.6.15e.

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As with performance in collaborative problem solving, attitudes towards collaboration might be influenced by pedagogical methods, but teachers might also choose certain pedagogical methods based on their students' attitudes towards collaboration. While no causal relationship can be claimed from these results, the results indicate that there is a positive and significant relationship between pedagogical methods emphasising student interaction and student attitudes towards collaboration.

The questions used in the questionnaire were specific only to science class. The interpretation of the observed relationship depends on whether the pedagogical methods used in science class are representative of the ethos prevalent throughout the school. However, Table V.6.16 shows that, on average across OECD countries, 95% of the variation in the index of student interaction in science class is observed across students in the same school, while only 5% is seen between schools. Hence, students in the same school perceive a great variety of teaching methods in their science classes, which likely also extends to other subjects. As a result, there is limited evidence to support the notion that there is a school-wide ethos of such communication-intensive pedagogy.



## Notes

1. Examples of moderate physical activity are walking, climbing stairs and riding a bike to school. Students were asked whether they engage in moderate physical activity for at least 60 minutes a day.
2. Examples of vigorous physical activity are running, cycling, aerobics, soccer and skating. Students were asked whether they engage in vigorous physical activity that made them sweat and breathe hard for at least 20 minutes a day.
3. The number of days that students attended physical education class per week was top-coded down to at most five days per week.
4. The average difference across both genders is greater than the difference for either gender because of weighting: different proportions of boys and girls participated in zero and seven days of vigorous physical activity in the week prior to the PISA assessment.
5. The plateau in the index of valuing relationships after two days of vigorous physical activity per week seems to be due to boys. There is a progressive but not necessarily always significant increase in girls' attitudes towards valuing relationships with the number of days that they engage in vigorous physical activity, up to all seven days per week.
6. This distinguishes these activities from two other student activities that may have a social component to them: exercising or practicing sports outside of school, and working for pay. There is a greater barrier to taking part in these activities, as they most often occur outside the home, and students are more likely to take part in these activities on some but not all days of the week. As a result, a student's participation in these activities on the most recent school day is less likely to be representative of the average frequency of the student's participation in these activities.
7. It is not clear whether students play truant individually or in a group; truancy in a group may actually be a collaborative activity.
8. The exceptions are between students who did not skip a whole day of school and the statement "I find that teamwork raises my own efficiency"; students who did not skip any classes and the statement "I am a good listener"; and students who were never late and the statement "I am a good listener". Among students who did not display these truant behaviours, there was no significant relationship between the percentage of these students who agreed or strongly agreed to these statements and the proportion of students in their schools who did display these truant behaviours.
9. In this volume, students were deemed to have attended pre-primary school if they specified the age at which they started pre-primary school (ISCED 0). Results may differ from those in *PISA 2015 Results (Volume II): Policies and Practices for Successful Schools* (OECD, 2016), where students were deemed to have attended pre-primary school if they specified both the age at which they started pre-primary school (ISCED 0) and primary school (ISCED 1).
10. The uncertainty in the performance gap between students who did and did not attend a form of pre-primary education is large in many countries due to the relative lack of students who did not attend pre-primary school. Significant differences in these countries are therefore more difficult to ascertain. As a result, we only discuss countries where at least 5% of students (or at least one in 20 students) have not attended pre-primary school.
11. At the same time, it is noted that in some countries, notably those that do not provide this service for free, disadvantaged families may have more difficulty in affording pre-primary education.
12. Students from disadvantaged families are defined as those in the bottom quarter of the PISA index of economic, social and cultural status in their country/economy.
13. Students from advantaged families are defined as those in the top quarter of the PISA index of economic, social and cultural status in their country/economy.

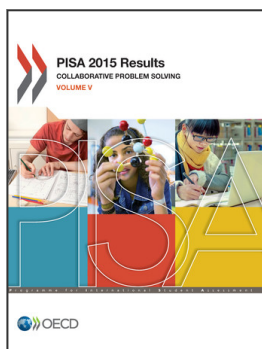
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