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Student Learning Time: A Literature Review

By Anna Gromada and Claire Shewbridge

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This paper was prepared by Anna Gromada (during an internship at the Early Childhood and Schools Division, June-December 2013) and Claire Shewbridge from the OECD Secretariat. At the time of the internship, Anna Gromada was completing her master's degree in International Development at the Institut d'Études Politiques de Paris (Sciences Po). The paper is part of the work undertaken by the OECD Review of Policies to Improve the Effectiveness of Resource Use in Schools (School Resources Review) and includes revisions in light of the discussion of an earlier version [EDU/EDPC/SR(2014)3] at the first meeting of the Group of National Experts on School Resources (14-15 May 2014).
The purpose of the OECD School Resources Review is to analyse how resource inputs in school systems should best be distributed, utilised and managed to optimise school outputs, encourage successful teaching and learning and promote continuous improvement. The Review provides analysis and policy advice to help governments and schools achieve effectiveness and efficiency objectives in education. More information is available at: www.oecd.org/edu/school/schoolresourcesreview.htm.

This working paper has been authorised by Andreas Schleicher, Director of the Directorate for Education and Skills, OECD.

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STUDENT LEARNING TIME: A LITERATURE REVIEW

ABSTRACT

This paper examines student learning time as a key educational resource. It presents an overview of how different OECD countries allocate instruction time. It also develops a model to understand the effective use of allocated instruction time and examines how different OECD countries compare on this. The paper confirms the value of sufficient instruction time as a key educational resource, but the key conclusion is that what matters the most is the way in which allocated time is used. Student learning time and academic achievement seem to have complex and curvilinear relationship with diminishing returns to scale. The paper also cautions that there should be realistic expectations on how effectively students can learn throughout the school day and year. Accordingly, it suggests that instruction could be organised to better optimise times when students are better able to concentrate. Evidence on lost instruction time in different OECD countries points to areas of potential increased effectiveness within existing time allocations, for example by improving classroom management and matching instruction to better meet students' learning needs.

RÉSUMÉ

Ce rapport étudie le temps d'apprentissage des élèves en tant que ressource éducative principale et donne un aperçu de la façon dont les différents pays membres de l'OCDE répartissent leur temps d'instruction. Il propose de plus un modèle qui facilite la compréhension d'une utilisation efficace du temps d'instruction alloué et compare cette utilisation dans les différents pays membres de l'OCDE. Cette revue de la littérature confirme l'utilité d'avoir suffisamment de temps d'instruction en tant que ressource éducative principale, même si elle met davantage l'accent sur l'utilisation faite du temps alloué. Le rapport entre temps d'apprentissage des élèves et réussite scolaire paraît complexe et curviligne avec des rendements d'échelle décroissants. Cette revue encourage des attentes réalistes concernant le degré d'efficacité d'apprentissage des élèves au fil de la journée et de l'année scolaire. Par conséquent, le rapport suggère une meilleure organisation de l'instruction pour optimiser les périodes de concentration des élèves. Les données sur le temps d'instruction perdu au sein des différents pays membres de l'OCDE mettent en évidence des domaines d'efficacité potentielle accrue de la répartition du temps existant, en améliorant la gestion de classe et en faisant en sorte que l'instruction corresponde davantage aux besoins éducatifs des élèves, par exemple.

TABLE OF CONTENTS

Tables

Figures

Boxes

CHAPTER 1: ANALYSING STUDENT LEARNING TIME AS A RESOURCE

This Chapter presents the paper's analytical approach and includes an assessment of the paper's added value as well as its limitations.

Student learning time as a key educational resource

Concerns about effective use of resources in schools raise a question of how to distribute, allocate and organise resources in a way that would be most conducive to learning. Rearrangement of student learning time, next to reduction of class size and increase of teachers' salaries, has emerged as one of the key ideas for reallocation of newly available resources in countries with a decreasing number of students. Since it is argued that "the most valuable resource in the educational process is no doubt student learning time" (OECD, 2004: 240), optimising this resource has been presented as one of the key measures in improving student achievement (Carroll, 1989; Scheerens and Bosker, 1997; Marzano, 2003). While students acquire skills and knowledge in many different ways, this paper will concentrate primarily on the time students spend learning in regular school lessons and also consider their participation in summer and after-school programmes and extracurricular activities.

Different ways students spend time learning

This paper defines student learning time as a resource invested by students in three types of deliberate learning activities in institutional settings:

- Regular lessons at school: The time students spend on instructional activities in school. It should be underpinned by allocated instruction time (see below).
- Summer and after-school programmes: The time students spend in programmes created on the initiative of education authorities to offer additional work on curricular subjects either at school after regular school hours, or in other settings. These can offer remedial or enrichment instructional activities.
- Extra-curricular activities: The time students spend in voluntary classes dissociated from the regular curriculum and taking place after regular school hours in institutionalised settings.

It is of note that students invest time also in completing homework, that is, tasks decided by teachers in the classroom for completion by students during non-school hours. On average in the OECD, students in PISA 2012 reported spending 4.9 hours per week on homework or other study set by teachers; this was one hour less than reported on average in PISA 2003 (OECD, 2013b, Tables IV.3.27 and IV.3.48). While no relationship was found across the OECD countries between time students spend on homework and their performance, schools where students report spending more time on homework tended to perform better (OECD, 2013b, Table IV.1.2). However, this paper does not examine time that students invest in homework.

The importance of time as a resource in Carroll's time model

In 1963, Carroll outlined the theoretical importance of time as a resource for student learning. He conceptualised the degree of student learning as a product of the time students spend learning divided by the time they need to learn (Figure 1.1). The time students spend learning depends on their opportunity to learn (time allocated for learning) and their level of perseverance (time engaged in learning). Instruction time, or the total number of allocated classroom hours, accounts for a major part of public spending on non-tertiary education and constitutes a key resource that offers opportunity to learn (OECD, 2013a). The time needed for students to learn depends on their aptitude, the quality of instruction they receive and their ability to understand the instruction. Carroll's model suggests that, everything else being equal, increasing the time that students invest in learning will lead to better academic performance and, consequently, that deciding on the amount of instruction time is a key decision for policy makers (Berliner, 1990; Bellei, 2009; Brown & Saks, 1986; Carroll, 1963, 1989).

Figure 1.1 Theoretical importance of time for student learning: The Carroll Model

$$Degree\ of\ learning = f\left(\frac{(Time\ allocated\ for\ learning)\ \times\ (Time\ engaged\ in\ learning)}{(Time\ needed\ to\ learn) \times (Quality\ of\ instruction \times Ability\ to\ understand)}\right)$$

Berliner (1990) argues that the Carroll model can be used to compare the more efficient use of time and also to account for the use of scarce time resources, such as the teacher's planning time or the time devoted to one-on-one instruction.

Added value and limitations of the paper

This paper attempts to examine the allocation and use of student learning time as a key educational resource. It provides an overview of the allocation of student learning time in OECD countries. Based on an overview of research, it develops and presents a model to understand the effective use of allocated instruction time and illustrates different phenomena of time loss and how these vary among OECD countries.

A model to analyse the effective use of allocated instruction time

In an aim to understand how effectively allocated instruction time is used, the following concepts are analysed:

- Allocated instruction time: the annual intended number of hours that students should spend in formal classroom settings, learning compulsory as well as non-compulsory parts of the curriculum as per public regulations (OECD, 2011).
- Actual lesson time: the amount of allocated instruction time remaining for actual instruction after initial losses due to exceptional school closures and teacher and student absences or lateness.
- Engaged time: the amount of actual instruction time, once time spent on administrative and disciplinary issues has been subtracted, during which students seem to pay attention (Berliner, 1990).
- Actual learning time: the time during which students are focused on academic material of relevant difficulty that allows them to experience success (Cotton, 1989).

Limitations

First, this paper aims to provide an overview of different practices among OECD countries in how they organise compulsory education and allocate instruction time. To do so, it brings together information as reported by countries on a common international indicator framework. While this has the advantage of providing a greater degree of comparability, it must also be borne in mind that OECD countries report this information in a variety of ways, sometimes drawing on central specifications, sometimes on survey data and sometimes providing estimates from different sub-national information. Also, information may relate to minimum, recommended or even total instruction time, depending on the country.

Second, this paper aims to examine the effectiveness and efficiency of different approaches to organising student learning time. The paper presents a summary of research, but this is subject to several limitations:

- *Lack of information on costs*: Most of the quoted research focused on effectiveness, or measuring whether different time allocations influence student achievement. Very few of the studies looked at the costs of different uses of time. Research on student learning time has not yet developed a comprehensive model that would allow for analysis of comparative cost-effectiveness. This shortcoming raises a bigger question of how to measure costs borne by the society as a whole; for example, the cost of organising supervision for children in the absence of after-school services, that are usually borne by parents. In the face of scarcity of efficiency studies, the primary suggestion for further study is to develop this strand of research.

- *Inconsistent ways of measuring "time"*: Research on student learning time is complicated due to the inconsistent ways of measuring and defining concepts across literature, with some studies making only generic references to "school day" or "class time" (Aronson, Zimmerman and Carlos, 1998). Definitions of "time" vary significantly in education research and may confound the influence of time with aspects of teaching quality (Scheerens et al., 2013).

- *A dominance of correlational data*: Most of the quoted research relied on correlational data with time constructs as independent variables and test scores as dependent variables. There are comparatively few longitudinal or experimental studies that allow inference of a cause and effect relationship. Since most of the studies on the topic adopt a short-term perspective, they usually measure achievement through pre-test and post-test in the form of tasks to be completed. This approach offers only limited insight to the long-term results, given that schooling clearly has also non-academic benefits. Also, the paper draws heavily on results from cross-sectional international studies to examine how effectively instruction time is used. Relationship with performance cannot be clearly established, as no causal inferences can be drawn from cross-sectional data. There is a complex relationship between instruction time and student performance, e.g. some countries may increase instruction time as a measure to combat low performance, but this may not be sufficient to redress other educational differences compared to other OECD countries.

- *Lack of geographical coverage in research*: The lion's share of research quoted in this paper is from the United States with regard to studies on the effective use of time. The paper also draws heavily on research from France on students' learning rhythms. It is highlighted where this research has been validated in other countries, but caution must be taken when generalising findings internationally.

Structure of the paper

Chapter 2 provides an overview of different practices in OECD countries with regard to the overall length and organisation of compulsory schooling. It describes how different countries allocate instruction time for children of different ages and organise instruction and holidays through the school year.

Chapter 3 presents an overview of practices and evidence on changes in instruction time allocation in OECD countries. It examines responsibilities for time allocation and presents information on the costs and cost effectiveness of increasing instruction time.

Chapter 4 presents a model for understanding the effective use of allocated instruction time and examines evidence on how effectively instruction time is used in OECD countries.

CHAPTER 2: LENGTH AND ORGANISATION OF COMPULSORY SCHOOLING

This chapter provides an overview of different practices in OECD countries with regard to the overall length and organisation of compulsory schooling. It then describes how instruction time is allocated at different ages during compulsory schooling, presents a summary of research on children's different levels of alertness and fatigue at different ages and examines the cost implications of instruction time allocation at different ages. The chapter then provides an overview of how different OECD countries organise the school year. It provides a summary of research on the sequencing of instruction weeks and school holidays and examines the impact this has on different student groups.

The length and organisation of compulsory schooling

In all but four OECD countries (Estonia, Finland, Sweden and some cantons in Switzerland), children aged six have started compulsory education and by age seven, all children in the OECD have started compulsory education. Although compulsory education only goes until age 14 in four OECD countries, in all except Turkey and Mexico over 90% of 15 year-olds are enrolled in compulsory education (Table 2.1).

Table 2.1 End of compulsory education and actual enrolment patterns (2012)

Less than 90% of the population is enrolled at this age	*Expected end of compulsory education*	*90% of the population is enrolled up to this age*	*90% of the population is enrolled after this age*
Turkey (13)	*Age 14*		*Greece (17), Korea (17), Slovenia (18)*
Mexico (13)	*Age 15*		*Austria (16), Czech Republic (17), Japan (17), Switzerland (16)*
Luxembourg (15)	*Age 16*	*France, Iceland, Italy, New Zealand, United Kingdom*	*Canada (17), Denmark (17), Estonia (17), Finland (18), Ireland (18), Norway (17), Poland (18), Slovak Republic (17), Spain (17), Sweden (18)*
Australia (16), Israel (16), United States (16)	*Age 17*		
Chile (15), Germany (17), Hungary (17), Portugal (17)	*Age 18*	*Belgium, Netherlands*	

Notes: Numbers in brackets indicate the age at which over 90% of children are enrolled in school. In Canada the end of compulsory education varies among the Provinces from age 16 to 18. Over 90% of the population is enrolled at age 17.

In Belgium and Germany, compulsory education at age 18 is part-time (15 to 18 years in Belgium; 16 to 19 years in Germany).

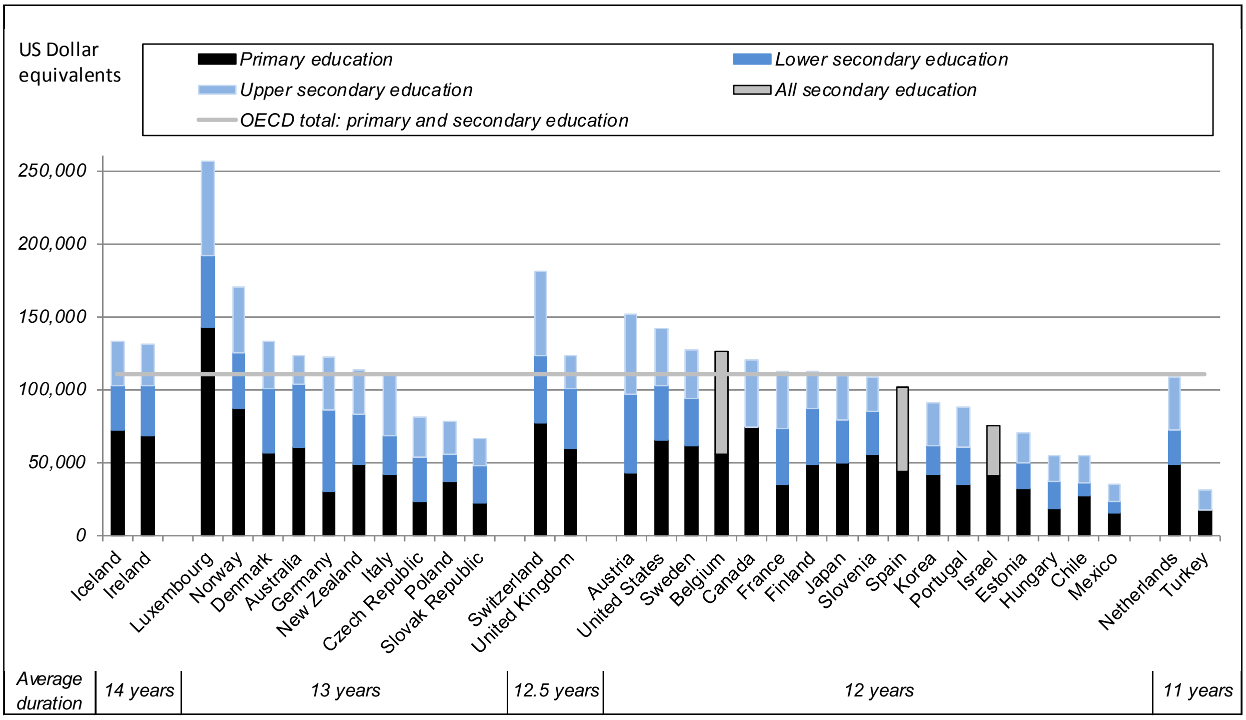
In Luxembourg, the actual enrolment rate is underestimated due to the fact that many residents go to school in neighbouring countries.

Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Table C1.1a.

Different OECD countries organise compulsory education in different ways. The average duration of primary and secondary education is 12 years in 17 countries, 12.5 years in 2 countries and 13 years in 10 countries (Figure 2.1). It is longest in Iceland (14 years) and Ireland (13.5 years) and shortest in the Netherlands and Turkey (11 years). OECD countries organise this time in different blocks of primary (5.9 years on average), lower secondary (3.2 years on average) and upper secondary (3.3 years on average) education (OECD, 2014b, Table B1.3b). For example, in 2014 the average amount of intended instruction time in public institutions for both primary and lower secondary education is 7 475 hours, but this ranges from 5 304 hours in Hungary (8 years of primary and lower secondary education) to 10 120 hours in Australia (10 years of primary and lower secondary education) (OECD, 2014b). The average duration is one factor that influences the cost of primary and secondary education. However, the cumulative expenditure per student varies among countries sharing the same average duration of primary and secondary education (Figure 2.1).

Figure 2.1 Cost and average duration of primary and secondary education in OECD countries (2011)

Cumulative expenditure per student by educational institutions for all services over the theoretical duration of primary and secondary studies

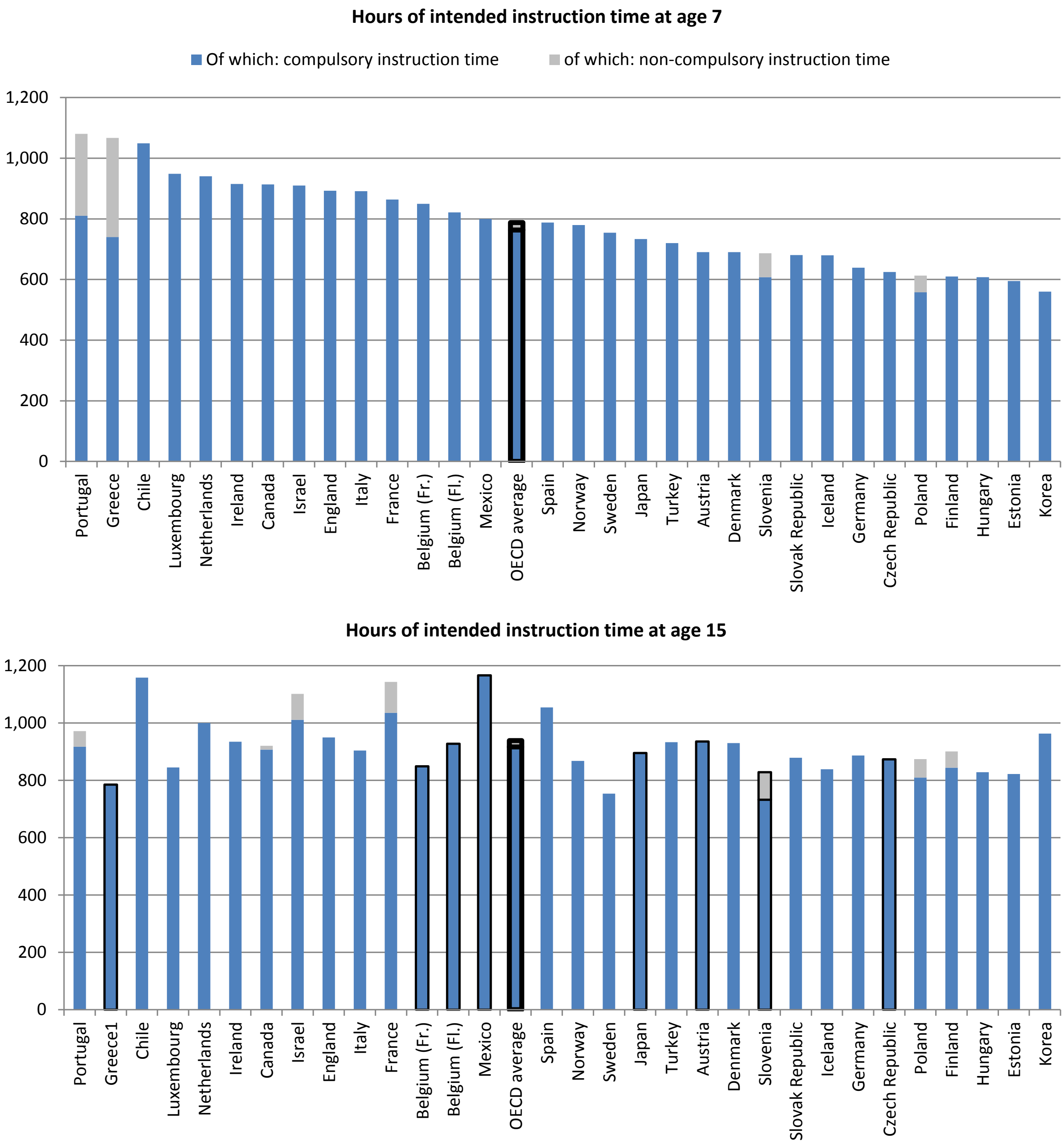


Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Table B1.3b.

Allocated instruction time at different ages

The OECD compiles international data on intended instruction time in public institutions and for the vast majority of OECD countries this is based on policy documents or regulations related to curricula (OECD, 2013a, Annex 3, Indicator D1). Data exclude hours lost when schools are closed for holidays and celebrations. On average in the OECD, the intended amount of instruction time for 7 year-olds in public institutions is 788 hours, although this varies considerably among countries and is over 900 hours in seven OECD systems (Figure 2.2). In the Netherlands, primary schools have to provide 7 520 hours of instruction over eight school years and schools are free to decide how they distribute these hours (a simple average of 940 hours is included in the international data).

Figure 2.2 Intended instruction time in public institutions at ages 7 and 15 (2014)



Note: Bars showing intended instruction time at age 15 in Greece, Belgium, Mexico, Japan, Austria, Slovenia and Czech Republic have a dark border indicating that data of instruction time at age 14 is used.

Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Table D1.4

The average amount of intended instruction time for 15 year-olds in public institutions rises to 939 hours, that is, on average 151 hours more than for 7 year-olds. In the majority of OECD countries with a relatively higher amount of intended instruction time for 7 year-olds, there is not a considerable difference in the amount of intended instruction time at age 15 (Figure 2.2). However, the notable exceptions are Chile, France, Israel and Mexico.

Conversely, there are considerable increases in the amount of intended instruction hours in those OECD countries where 7 year-olds have relatively fewer instruction hours compared to the OECD average. Fifteen year-olds in Denmark, Estonia, Finland, Germany, Hungary and Poland have between 221 and 292 more hours of intended instruction time compared to their 7 year-old counterparts; and this is around 400 hours more in Korea (Figure 2.2).

Research on general cycles of student alertness and fatigue at different ages

Student sleepiness at school is a wide spread phenomenon according to teachers' reports in international assessments – on average internationally, this limited the effectiveness of instruction for around half of Grade 4 students (e.g. Mullis et al., 2012b, Exhibit 8.10) and for nearly 6 out of 10 Grade 8 students (e.g. Martin et al., 2012, Exhibit 8.22). Research from different countries has identified the phenomenon that students experience different cycles of alertness and fatigue during the typical school day and week. This has been well documented for over a century and fits in with broader research on different cycles of alertness for human beings (Davila and Devolvé, 1994). Although there are individual differences that are reflected in learning time preferences (see Box 4.2), the observed fluctuations in human alertness also vary by age, which suggests that the amount of instruction time should be adapted accordingly.

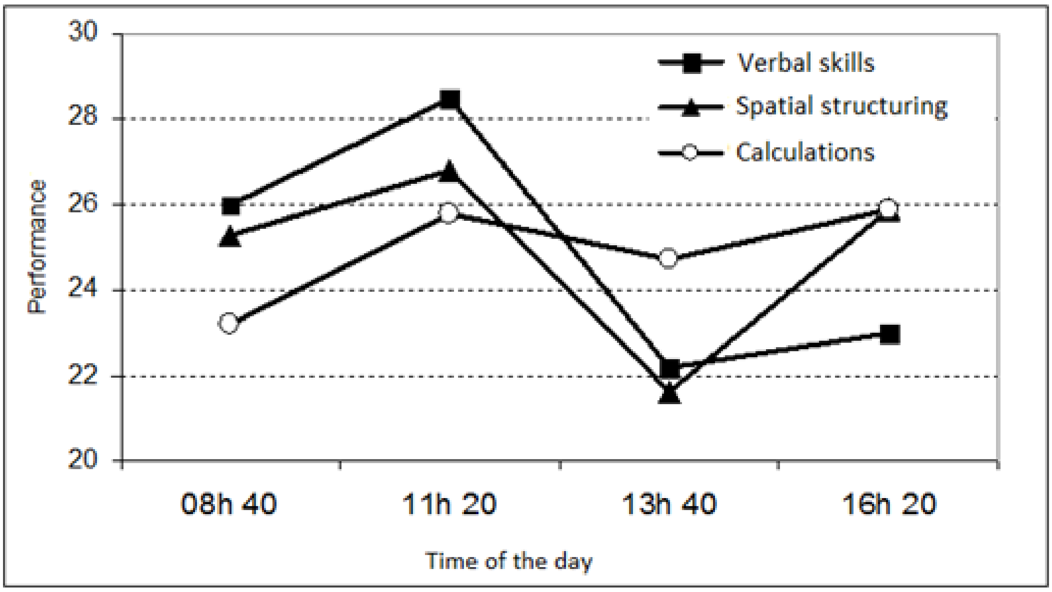
Cycles of alertness at different ages

Testu (2008) and Dubocovich et al. (2005) believe that research from different countries has identified some universal patterns. Baade (1907) observed two cycles of alertness among primary school children with their attention increasing until around a.m., falling until 2 p.m. and recommencing. Later research (Rutenfranz and Hellbrügge, 1957; Fischer and Ulich, 1961) found that school age participants performed best on mathematics calculations between 10 a.m. and midday and between 3 p.m. and 4 p.m., while they performed worst during the first hour of the school day and around 2 p.m. More recent research also identified similar daily cycles of students' alertness in the United Kingdom, Germany, Spain, Israel and the United States (Andrade and Menna-Barreto, 1996; Klein, 2004). Testu (1994a, 1994b, 2008) finds that children aged 10 to 11 have an initial low level of alertness around 8 a.m. to 9 a.m. and that this rises to a peek of alertness around the end of morning classes (11 a.m. to 12 p.m.) (Figure 2.3). There is a second low in level of alertness immediately after lunch break, but alertness increases to an afternoon peak around 4 p.m.

Importantly, the observed cycles of alertness change significantly as children grow up. Both the length and amplitude of cycles of alertness change with age. For example, students aged 13 to 14 have their attention peaks later than those aged 9 to 10 (Fischer and Ulich, 1961). Also, the youngest children (aged 5 to 9) tend to have a much weaker or even negligible peak of alertness in the afternoon and, consequently, show much weaker afternoon performance than older students. In research between 1972 and 1978 on teaching behaviours that are conducive to learning, Fisher (1978) found higher estimates of actual learning time for children in higher grades, reflecting that older children could concentrate for longer periods of time (11 minutes of mathematics and 19 minutes of reading in Grade 2; 15 minutes and 35 minutes respectively in Grade 5).

Accordingly, some researchers advocate for different amounts of instruction time for children of different ages. Touitou and Bégué (2010) believe that a system which would respect biological rhythms should encompass, depending on the age, 4 to 6 hours of instruction time a day, 4 days and a half up to 5 school days a week and 180 to 200 school days a year. In turn, *La ligue de l'enseignement* (2010) advocates a daily instruction time of five hours for primary school children due to their more limited attention span. Suchaut (2009) argues that time organisation should take into account research evidence and limit the school week to around 20 hours until the 3rd Grade and introduce a shorter daily instruction time distributed across a larger number of days. This should be no more than six hours of instruction per day in lower secondary school and no more than seven hours in upper secondary school. Testu (2008) suggests that increases in the weekly number of hours should occur as a function of a student's age, with 21 hours for children aged 6 to 9, 25.5 hours for children aged 9 to 13, 28 hours for students aged 13 to 15 and 31 hours for those aged 16 to 19. For all age groups, Testu advocates classes beginning no earlier than 8.30 a.m. and a long midday break (12 to 2.30 p.m.) that would help in managing the midday fall in levels of student alertness.

Figure 2.3 Daily performance variations for 10 to 11 year-old students



Source: Reproduced from Suchaut, B. (2009), "L'organisation et l'utilisation du temps scolaire à l'école primaire: enjeux et effets sur les élèves", in Conférence à l'initiative de la ville de Cran-Gevrier; Haute-Savoie. Data on the graph relies on results from Testu F. (1994b), "Étude des rythmes scolaires en Europe", Les Dossiers d'éducation et formations, Ministère de l'Éducation nationale, DEP, 1994, N°46, pp. 1-97.

Changing sleep patterns for older children

An additional factor that impacts students' levels of alertness as they grow older is changing sleep patterns. During the school year, students sleep significantly less than during holidays (Touitou and Bégué, 2010). As a compensatory measure, adolescents sleep much longer over the weekends and holidays, desynchronising their sleep patterns, as observed in Poland (Szymczak et al., 1993). In the United States, Carskadon (1999) challenged the popular belief that such sleeping patterns reflect purely behavioural factors, such as late work, social activities or media use, but rather result from a complex interplay of psychosocial and biological factors, e.g. pubertal phase delay.

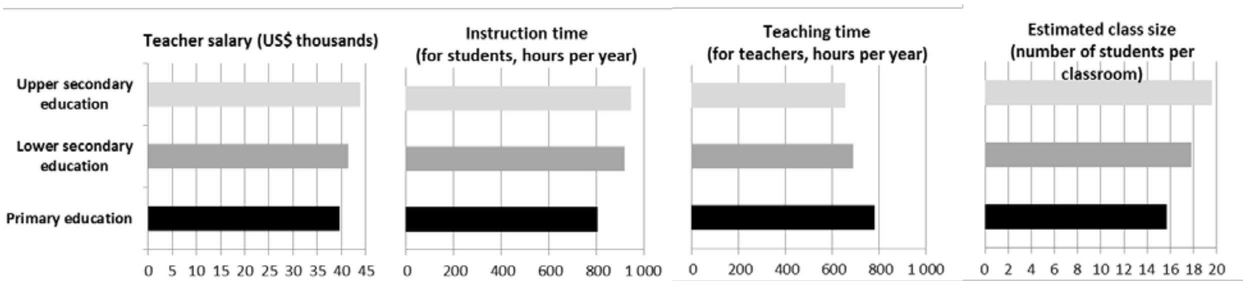
Deficient sleep has been shown to impair memory, attention, reaction time, mood and divergent thinking (Carskadon et al., 1997; Carskadon, 1999; Martin, 2003) as well as to contribute to disciplinary problems (Carpenter, 2001). The duration of sleep has been also shown to be related to school grades, with more hours of sleep having a positive influence on school performance in the United States (Allen, 1992; Wolfson and Carskadon, 1998) and in Israel (Epstein, Chilla and Lavie, 1995). Wolfson and Carskadon (1998) studied 3 120 Rhode Island students aged 13 to 19 and found that students getting C, D and E grades slept on average 25 minutes less each night and went to bed on average 40 minutes later than students achieving the higher A or B grades.

Some research from the United States shows that older students fail to adapt their body clocks to the school schedule to the detriment of their well-being and performance. Wolfson and Carskadon (1998) found that students did not adjust their sleeping habits to suit the earlier start in upper secondary school, but slept on average 40 minutes less when transitioning from lower secondary school. In a subsequent longitudinal study, Carskadon (1999) examined the impact of the earlier school start on students as they transitioned to upper secondary school and found that students had pathological levels of sleepiness at 8.30 a.m. impairing their ability to learn in the early school hours. A school district in Minnesota experimented by changing the school start from 7.15 a.m. to 8.40 a.m. A survey of 7 000 high school students revealed increased amount of sleep during the week, slightly better school performance and fewer reports of depressive feelings (Carpenter, 2001).

Cost implications for the amount of instruction time at different ages

International data show that the salary cost of teachers per student increases with the level of education (OECD, 2013a). The increased amount of instruction time in secondary education compared to primary education contributes to these higher costs, along with higher teacher salaries (Figure 2.4). At the same time, larger classes in secondary education tend to reduce the salary cost of teachers per student.

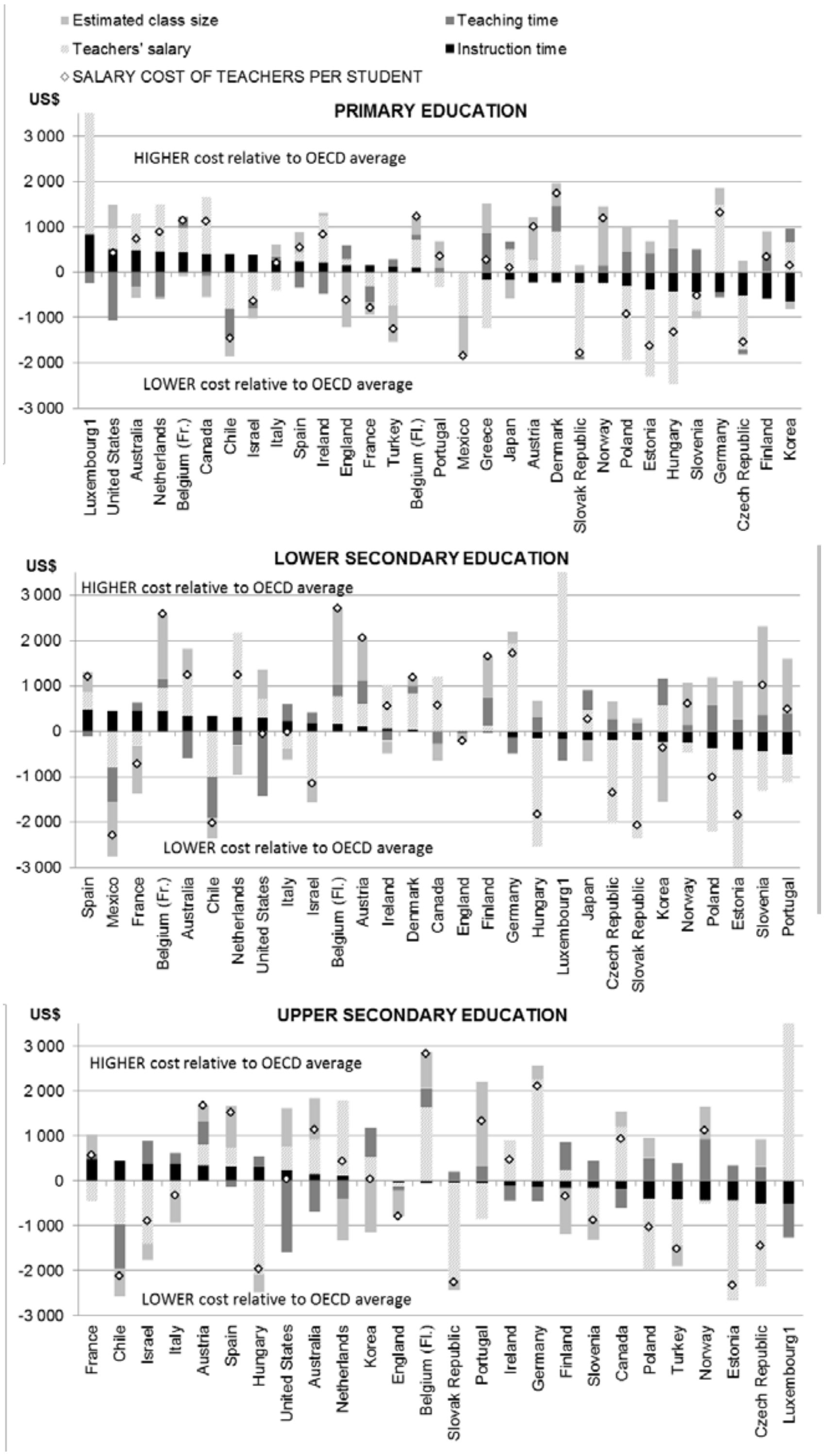
Figure 2.4 OECD average instruction time, teaching time, teacher salary and estimated class size at different levels of education (2012)



Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Tables B7.2a, B7.2b and B7.2c.

However, differences in instruction time allocation among OECD countries play only a modest role in explaining the differences in the salary cost of teachers per student (Figure 2.5). The major drivers of differences in salary cost of teachers per student are teachers' salary and the estimated class size (OECD, 2013a).

Figure 2.5 Contribution of instruction time to the salary cost of teachers per student (2012)



Note: Countries are ranked in descending order of the contribution of instruction time to the salary cost of teachers per student.

1. Luxembourg: salary cost of teachers per student is USD 10 704 in primary education, USD 12 019 in lower and upper secondary education.

Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Tables B7.3, B7.4 and B7.5.

Even so, the different country choices in the amount of allocated instruction time at different ages are reflected in the international data on salary cost of teachers per student. In countries where the amount of instruction time for 7-year-old students is relatively low compared to on average in the OECD (Figure 2.2), this plays a modest role in lowering the salary cost of teachers per student relative to on average in the OECD (Figure 2.5). However, the only countries where a comparatively lower amount of allocated instruction time is one of the main drivers of differences in salary cost of teachers per student in primary education are Finland, Korea and Slovenia. In secondary education, instruction time is one of the main drivers of differences in salary cost of teachers per student in Spain at the lower secondary level and in France at the upper secondary level – in both cases contributing to higher costs relative to on average in the OECD.

Organisation of the school year

In the OECD, the school year varies significantly due to the different seasons in the Northern and Southern hemispheres. There are three broad blocks of countries according to when the school year starts:

- January to February: In Australia and New Zealand, the school year runs from late January or early February to mid-December, while in Chile from late February or early March to mid-December.
- March to April: In Korea, the school year runs from March to February and in Japan from April to March.
- August to September: In most European countries, the school year starts at the beginning of September and ends in mid-June. In the Nordic countries (Denmark, Finland, Sweden, Norway and Iceland) the school year runs from mid-late August until mid-June. In Canada and the United States, the school year runs from early September until June; in Mexico from mid-August until July; and in Israel from late August to late June. In Greece, Portugal and Turkey, the school year runs from late September until June.

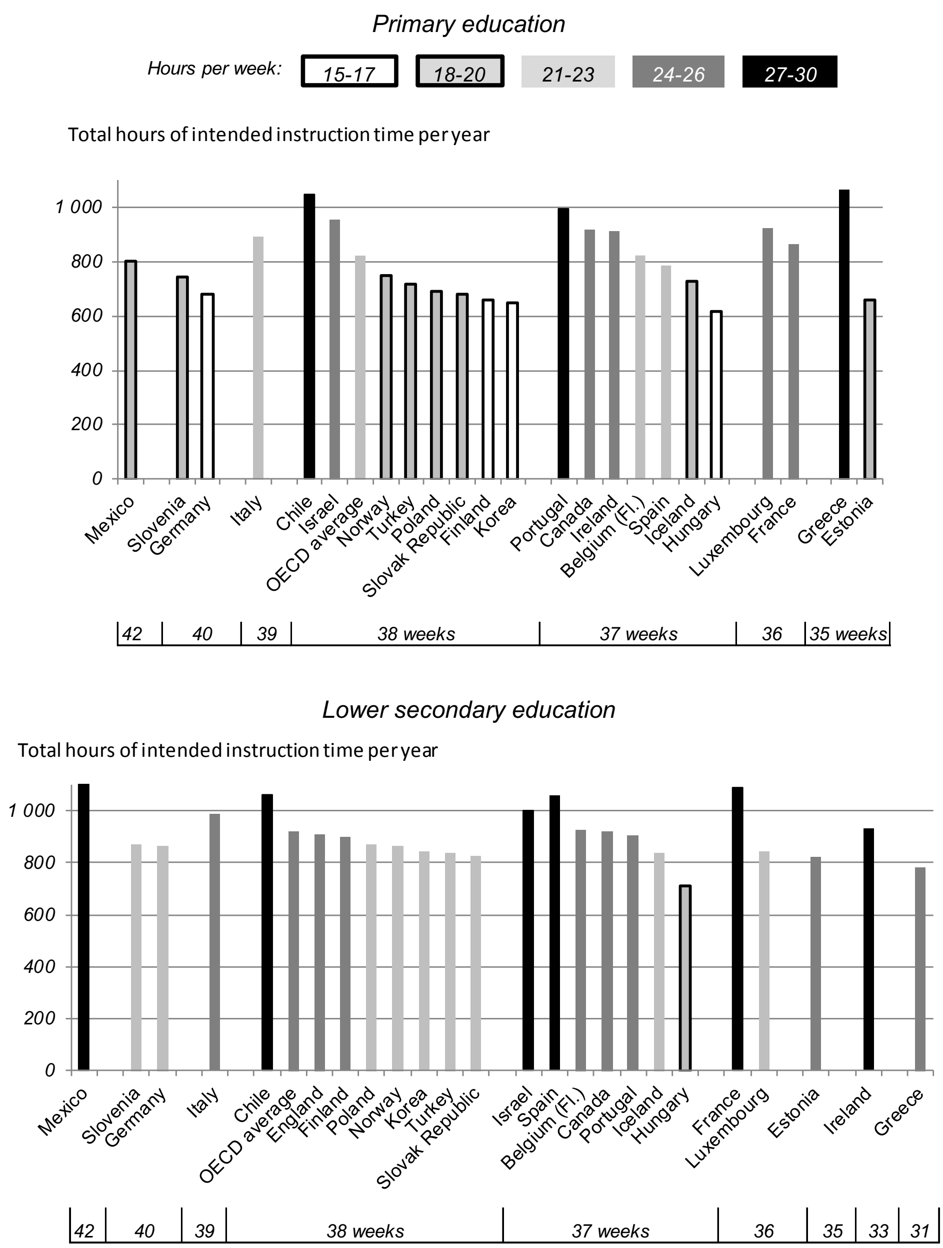
In 2011, the OECD average school year for students in primary education comprised 38 weeks of instruction ranging from 35 weeks in Estonia to 42 weeks in Denmark (Figure 2.6). In the majority of OECD countries, the number of weeks of instruction are the same in primary and lower secondary education. But in Israel, Ireland, Poland and Greece, there are fewer weeks of instruction at the lower secondary level. Given the increase in allocated instruction time for older students in many countries (Figure 2.2), there is a higher intensity of weekly instruction time for students in lower secondary education, as shown by the darker bars in Figure 2.6. In 2014, in all but two OECD countries with available data, children have an average of 5 instruction days per school week (OECD, 2014b, Table D1.2). The exceptions are Israel (6 days) and France at the primary level (4.5 days).

The allocated instruction time varies significantly among countries with the same number of weeks of instruction resulting in different intensity of weekly instruction time for students. For example, among the countries with 38 weeks of instruction in primary education, Finland allocates 661 hours of instruction, while Chile allocates 1 049 hours of instruction. This translates into 17 hours per week for primary school students in Finland and 28 hours per week for their counterparts in Chile (Figure 2.6). Similarly, while both the Flemish Community of Belgium and Ireland allocate around 930 hours of instruction in lower secondary education, this is over a period of 37 weeks in the Flemish Community of Belgium compared to 33 weeks in Ireland, meaning students in Flemish lower secondary schools have fewer hours of instruction per week (25 hours, compared to 28 hours in Ireland). For countries with available data, there is no clear relation between intensity of instruction and teacher reports on student sleepiness impacting instruction (Figure 2.6 and Mullis et al., 2012b). Although this is particularly high in France where a reform in 2013 redistributed the hours of instruction during the school week in primary education (see Box 2.1).

The sequence of instruction weeks and breaks

In 2011, primary and lower secondary students had 14 weeks of school holidays on average in the OECD (Figure 2.6). These can be distributed among different parts of the school year and the sequencing and length of breaks varies among countries. Among the OECD countries in Europe, the length of summer holidays varies from 6 to 13 weeks (Figure 2.7). Historically, the long summer breaks in Western school calendars were designed to fit the needs of local, typically agricultural communities (Noonan, 2002; Schell and Penner, 1993). For example, in the United States before standardisation of calendars in the 20th century, some rural schools offered only six months of instruction, or approximately two times less than urban schools, which organised 11 or even 12 months of classes (Patall et al., 2010).

Figure 2.6 Number of weeks of instruction and allocated instruction time (2012)



Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Tables D1.1 and D4.1.

Box 2.1 Reform of the length and organisation of the primary school year in France (2013)

Traditionally, French students have had very long school days throughout compulsory education. At the start of the 20th century, annual instruction time was 1338 hours (Suchaut, 2009), but in 2011 this had dropped to 864 hours in primary education and 1081 hours in lower secondary education (Figure 2.6). The decrease was achieved by cutting the number of school days while maintaining their intensive character. In primary education, for all students without learning difficulties, the weekly workload has changed only slightly from 30 to 27 hours in 1969, when instruction on Saturday afternoon was eliminated, then to 26 hours in 1989 and to 24 hours in 2009 (Suchaut, 2009 and Figure 2.6).

In 2011, France allocated 864 hours of instruction during primary education over a period of 36 weeks, meaning 24 hours of instruction per week for students (Figure 2.6). A reform in 2008 had shortened the school year, reorganizing the primary school week into only four days (in contrast to the prevalent five or six days in other European countries), at the expense of making very long days for students (French Ministry of Education, 2013 a and b). In 2011, French children spent 141 days in primary education, the lowest in the OECD, compared to an OECD average of 185 days (OECD, 2013a, Table D4.1). Already in 1980, a report by the Economic and Social Council in France criticised the long school days as contributing to students' fatigue, especially during the months of October, November, February and March. Internationally, French teachers reported the highest levels of student sleepiness being an obstacle to effective instruction (this was the case for 80% of Grade 4 students in France, compared to 49% on average internationally) (Mullis et al., 2012b, Exhibit 8.10). Research by François Testu and Bruno Suchaut had identified the mismatch of school rhythms to children's biological cycles and energy levels as the source of fatigue and impaired knowledge acquisition.

While French children will still have 864 hours of allocated instruction time during primary education, the 2013 reform lengthens the school year to 180 days by introducing a 24-hour school week divided into nine half-days with a lower workload per unit. The 2013 reform aims "to avoid fragmentation of time, especially that of the smallest children, to integrate into the school day time dedicated to personal work, to develop breaks that are genuine moments of rest and use the 'out of school time' to fight against inequality" (French Ministry of Education, 2013 a and b). Children go to school on Monday, Tuesday, Thursday, Friday and Wednesday morning (although with appropriate justification, school administrators have an option of replacing Wednesday morning with Saturday morning). Students have up to 5.5 hours instruction time per day and up to 3.5 hours per half-day with the lunch break of at least 1.5 hours.

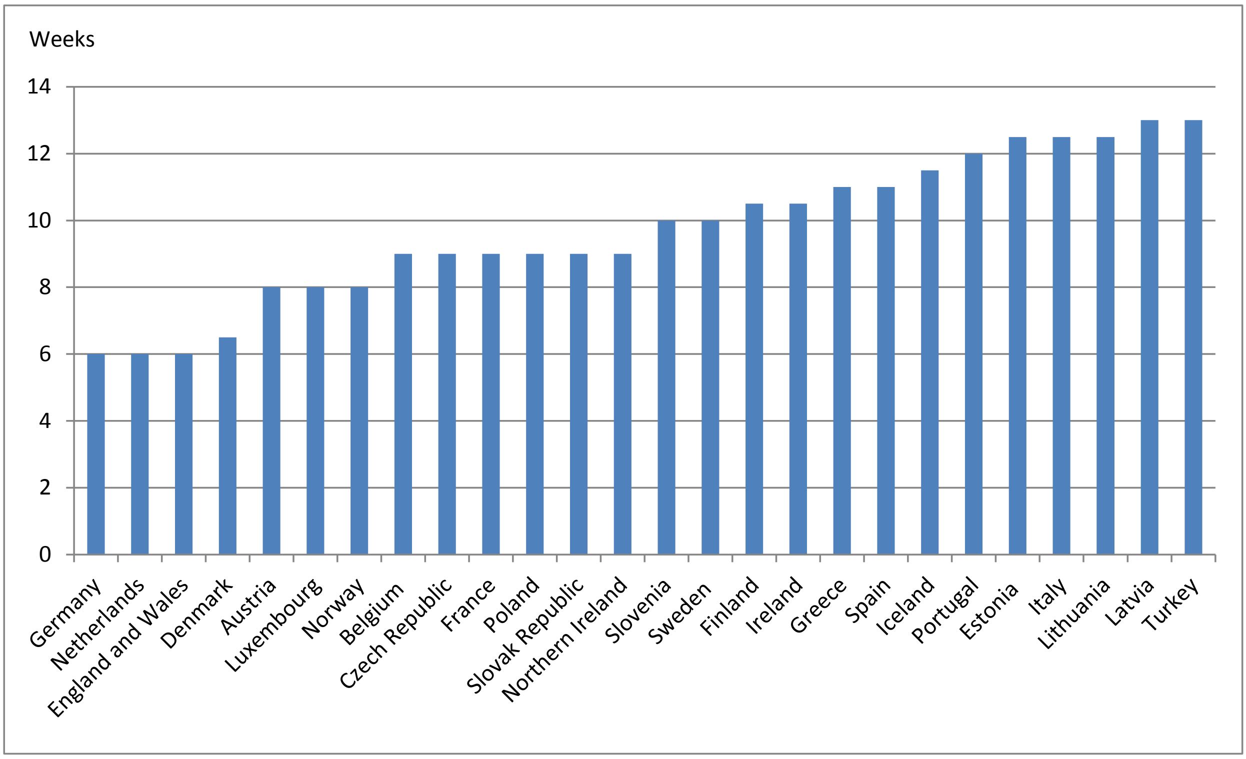
The 2013 reform guarantees that children have institutionally organised activities until 4.30 p.m. each day. It is expected that this will be offered via the extension of existing arrangements at the local level and stimulate further collaboration among local authorities (les communes). However, an exceptional startup funding of EUR 250 million was put in place for the academic year 2013/14. This was to help all local authorities that chose to implement the reform in 2013 in the initial extension and organisation of these arrangements. All such local authorities would receive EUR 50 per student and some rural or urban authorities classified as being the most disadvantaged would receive an additional EUR 40 per student. While the exceptional startup funding would only be available in 2013/14, the most disadvantaged local authorities would continue to receive a total of EUR 45 per student in 2014/15.

Source: French Ministry of Education (2013a), La Réforme des Rythmes à l'Ecole Primaire, http://www.education.gouv.fr/cid66696/la-reforme-des-rythmes-a-l-ecole-primaire.html.

Substantial economic and social changes in OECD countries have brought into question the length and organisation of the school year. For example, longer holidays can be problematic for children in families where both parents work or in sole-parent households (Chapter 3). Countries with shorter summer holidays usually organise more frequent breaks during the school year (Eurydice, 2013). In the majority of OECD countries in Europe, Christmas holidays are around two weeks; other seasonal breaks may include spring/Easter and autumn holidays. In addition to seasonal breaks, the European OECD countries offer one to ten additional days of holidays for national or religious reasons (Eurydice, 2013). In most countries, school holidays are very similar for both primary and secondary schools. Although the number of school days is typically set at the central or state level (see Chapter 3), decisions on the actual dates for holidays may be taken at the local or even school level, depending on the governance structure.

During the year, students show cyclical periods of resistance and vulnerability. In the Northern Hemisphere, there are higher levels of both fatigue and illness among children in November, February and March (Suchaut, 2009). Davila and Devolvé (1994) identified that the memory skills of 4th Grade students aged 10 to 12 were 20% worse in February than in June, even after taking account fluctuations in weekly levels of alertness. It was not clear whether this was due to an effect of "cumulated fatigue" or seasonal factors. For Reinberg (1998) it is the changing seasons that offer a more powerful explanation, as human beings are more physically and mentally vulnerable during winter, as witnessed in the Northern Hemisphere by higher rates of morbidity in mid to late February and to a lesser degree in November. However, Testu (2008) supports the argument of cumulated fatigue and points out that in many Western calendars, these periods of fatigue and vulnerability occur after 9 to 10 weeks of instruction. Along with Suchaut (2009), Testu (2008) advocates the "7-2 cycle", that is, seven weeks of instruction followed by two weeks of holidays. He argues that children start to restore their proper rhythm of sleep and alertness only after four to seven days of break and that the school break should aim to relax students in preparation for the next session of school work.

Figure 2.7 Duration of summer holidays in European OECD countries (school year 2014/2015)



Source: Figure prepared using data from Eurydice (2014), Organisation of school time in Europe: Primary and secondary general education, http://eacea.ec.europa.eu/education/eurydice./documents/facts_and_figures/school_calendar_EN.pdf.

How sequencing of instruction weeks and breaks affects different types of students

Different researchers have noted a phenomenon of "the summer of forgetting": during the summer break students forget what they have learned in the previous school year. Furthermore, this is documented to impact students from different socio-economic backgrounds in different ways. Barbara Heyns (1987) showed that achievement among different socio-economic and ethnic groups diverges more over the summer than during the school year. Alexander et al. (2007) argue that while the overall cumulative achievement accruals in the 9th Grade primarily reflect learning during the school year, the difference in achievement between students of the same age is partly explained by the different summer experience of students from different socio-economic backgrounds. Yet, the learning loss is unequal across subject areas. Mathematical skills appear to be more "democratic" with children experiencing an average decrease in mathematics equivalent to one month of instruction with little differences among students from different socio-economic background. In other academic areas, and especially regarding language skills, the summer break works to the relative advantage of children from more advantaged socio-economic backgrounds who accumulate more learning gains (Heyns, 1987; Alexander, Entwisle and Olsen, 2001; Downey, Hippel and Hughes, 2008). Smith and Brewer (2007, in OECD, 2012a) even identified the cumulative effect of summer learning differences as the primary cause of widening achievement gaps between disadvantaged and more advantaged students.

Organising instruction over a longer period of weeks

In the United States, one attempt to reduce the negative impact of the long summer break is the organisation of year-round schools, where the same number of classes is distributed more evenly across a twelve month period, i.e. with a significantly shorter summer break (Funkhouser et al., 1995). In 2000, over two million, or approximately 4% of all students, attended year-round schools (National Association of Year Round Education, 2000). However, the meta-analysis of Cooper et al. (2003) showed that the modified school calendar had almost no effect on performance without introducing other quantitative or qualitative changes.[1] McMullen and Rouse (2012) replicated these findings and conclude that year-round schools have no significant influence over the school performance of the average student, or over students from different ethnic and racial backgrounds. However, the introduction of year-round schools in Wake County, North Carolina, increased infrastructural capacity by 20-33% meaning that for every four schools operating on a year-round calendar one complex of school premises less is needed (McMullen and Rouse, 2012). Funkhouser et al. (1995) also note that year-round schools have been promoted as a way to save on school infrastructure. It could be argued that year-round schools keep the same school results while decreasing costs and, therefore, increase efficiency.

Organising targeted summer programmes

Alexander et al. (2007) believe that schooling does have a compensatory character and consequently that remedial and enrichment classes organised over the summer could have equalising effect for students from relatively disadvantaged backgrounds. Glass (2002) believes that summer programmes can be one of the most promising targeted interventions. Cooper, Charlton, Valentine and Muhlenbruck (2000) in their meta-analysis of 93 summer programme evaluations showed positive effects of summer schools regardless of whether they were designed to offer remedial or enrichment activities. The strongest predictors of their positive impact on student achievement were students' regular attendance and the programmes' design, with the most successful offering one-to-one tutorials or small classes (National Academy of Education, 2009). Successful remedial classes were staffed by school teachers and were aligned to the school curriculum (Cooper et al., 2000). Students who participated on a regular basis for three consecutive years made a progress of 40-50% of a grade as measured by standardised tests (National Academy of Education, 2009 quoting Borman and Dowling, 2006). Although Cooper et al. (2000) observed benefits for all participating students, these were less pronounced for students from relatively less advantaged socio-economic background, which may be explained by the fact that the most effective programmes were linked to intensive parental involvement.

1. A negligible effect size of d= 0.06.

Summary and implications

Different OECD countries organise compulsory education in different ways, with some requiring students to spend more years learning than others. While this has implications for the overall cost of education, costs vary enormously among countries with the same average duration of compulsory education. Some OECD countries allocate relatively high amounts of instruction time for students aged 7 and 15 with relatively modest increases in instruction time for older students; others choose to allocate relatively low amounts of instruction time for students aged 7 and to increase this significantly as children grow older. Research has shown that children have different levels of alertness and fatigue at different ages, with younger children showing shorter periods of alertness in the afternoon. At the same time, adolescents change sleeping patterns, which heightens the risk for reduced levels of alertness in the early morning period. This suggests that a different organisation of instruction time at different ages would be most effective.

The increased allocation of instruction time for older children in secondary education contributes to the increased salary cost of teachers per student relative to teachers in primary education. However, cross-country differences in instruction time allocation only play a modest role in explaining the different salary cost of teachers per student in OECD countries. This is only the most important explanatory factor in Finland, Korea and Slovenia, where allocated instruction time in primary education is particularly low compared to other OECD countries.

The majority of OECD countries organise the school year over the same number of weeks in both primary and secondary education, despite the increased allocation of instruction time for students. This results in a higher intensity of instruction time for students in secondary education. Still, there are notable differences among OECD countries in the number of weeks of instruction per year. The length and timing of holidays may influence the intensity of weekly instruction time for students during the school year and could be used to help address the fact that students experience greater levels of fatigue at different times during the school year. Summer holidays are far longer in some countries than in others. Research has shown that all students experience knowledge loss during the summer holidays, but students from less advantaged socio-economic backgrounds experience this to a greater degree. The shortening of summer holidays has been shown to be insufficient to address performance differences without accompanying improvements in quality of instruction, but does offer cost savings on school infrastructure when organised effectively. Regular attendance at summer programmes can have a positive impact on student performance, but these are most effective when aligned to the curriculum and taught by school teachers.

CHAPTER 3: CHANGES IN INSTRUCTION TIME ALLOCATION

This chapter examines practices and evidence on changes in instruction time allocation in OECD countries. It provides an overview of responsibilities for instruction time allocation in different OECD countries. It then presents a summary of arguments made in education research regarding how changes in instruction time impact different stakeholders. The chapter then presents evidence on how changes in instruction time influence student performance and whether this differs for different student groups. Finally, the chapter presents information on the costs and cost effectiveness of increasing instruction time.

Changes in instruction time allocation as a central policy lever

While international data indicate the majority of OECD countries give schools autonomy over many aspects regarding the organisation of instruction (OECD, 2012b), in sixteen OECD countries, responsibility for allocating instruction time lies at the central level and in six at the state level (Table 3.1). In the remaining countries where either the local administrative level or schools have responsibility for allocating instruction time, this is done against a central framework for instruction time. The only exception is England (United Kingdom) where schools have full autonomy for instruction time allocation, although each school day must comprise two sessions with a mid-day break (OECD, 2013a, Annex 3). Thus, across the OECD, the allocation of instruction time is an important central policy lever. These two broad country groupings (central and state responsibility versus school and local responsibility) have been observed over the past decade. In 1999, 23 out of 25 OECD countries had a national curriculum document specifying the amount of time to be allocated to the various subject areas (OECD, 2001).

Table 3.1 Responsibility for deciding allocation of instruction time in public lower secondary schools

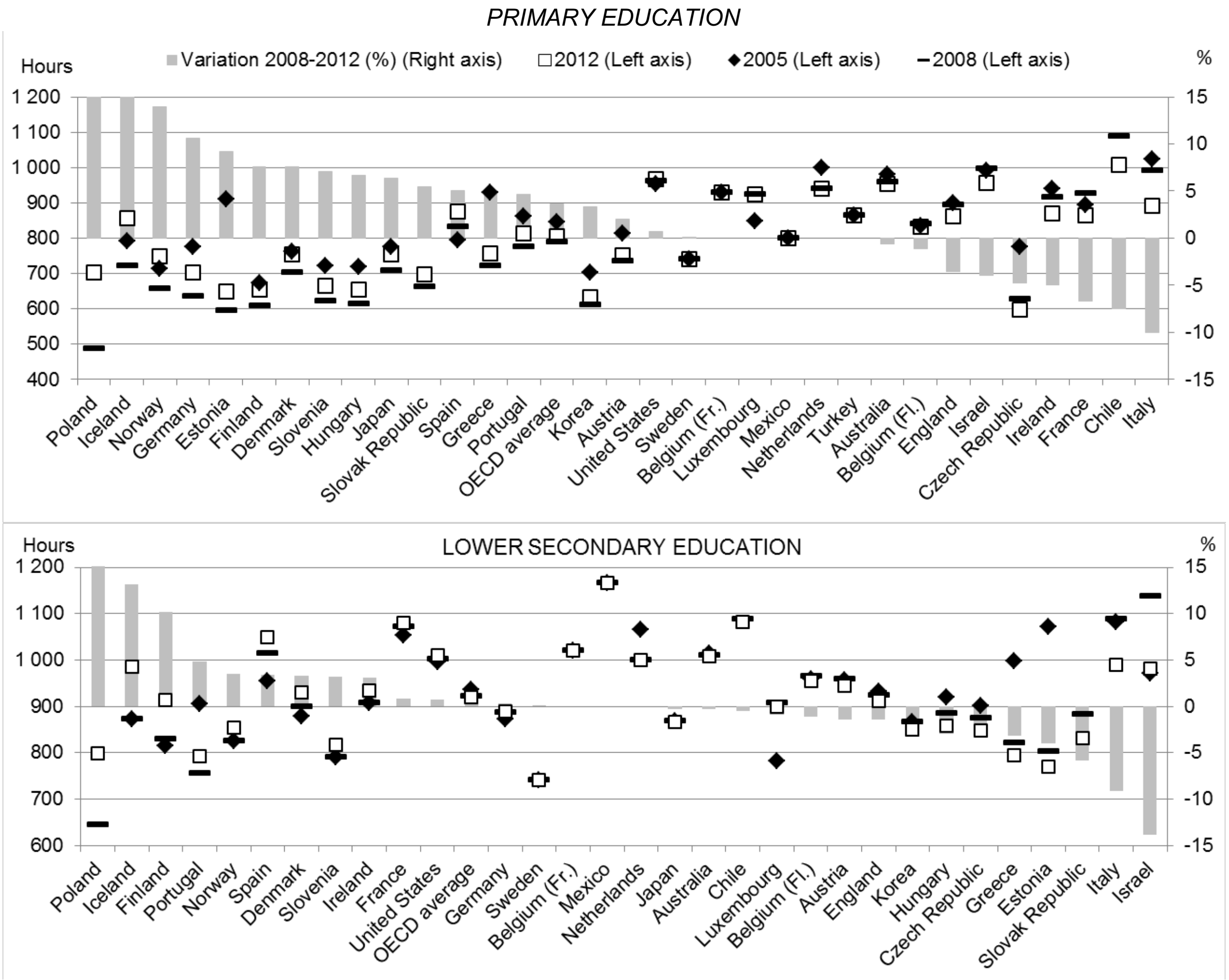
Level responsible	*School*	*Local*	*State*	*Central*
Decision taken in full autonomy	*England*		*Australia,* *Belgium (Fl. & Fr.), Canada, Switzerland*	*France, Hungary, Iceland, Ireland, Israel, Italy, Korea, Luxembourg, Mexico, Poland, Slovak Republic, Slovenia*
Decision taken after consultation				*Austria (state level), Portugal (school level)*
Allocated within a framework set by central level	*Chile, Czech Republic, Estonia, Finland (with local level), Japan, Netherlands*	*Denmark, Norway, Scotland, Sweden, United States (state level framework)*	*Spain*	
Other			*Germany*	*Greece, Turkey*

Source: OECD (2012b), OECD Family Database, www.oecd.org/social/family/database.htm, Table D1.3.

However, there have been some changes in responsibilities for allocation of instruction time. In 2003, schools in Hungary, Italy and Luxembourg were responsible for allocating instruction time within a central framework, but now this is decided centrally (OECD, 2005). Conversely, schools play a more prominent role in decisions to allocate instruction time in the Czech Republic (this was at the central level in 2003), Finland (only at the local level in 2003) and Portugal (the central level did not consult with schools in 2003) (OECD, 2005). In Finland, national regulations define the minimum total weekly lessons per year for both compulsory and non-compulsory subjects, but local authorities and schools decide on the distribution of lessons in different year classes within these limits (OECD, 2013a, Annex 3). A curriculum reform was implemented in the Czech Republic between 2007/08 and 2011/12, which introduces a central Framework Educational Programme for Basic Education with a specified minimum number of instruction hours in primary and lower secondary education, plus a minimum number of hours per week for different grade levels (OECD 2013a, Annex 3). Each school draws up a School Educational Programme and may increase the number of instruction hours. A similar reform was introduced in the Slovak Republic (Shewbridge et al., 2014).

Figure 3.1 Changes in instruction time in primary and lower secondary education (2005, 2008, 2012)

Number of hours per year of intended instruction time for students in public institutions



Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Tables B7.2a and B7.2b.

In some countries where central authorities remain responsible for instruction time allocation, a greater degree of flexibility has been introduced in central guidelines. In Korea, since 2011 the minimum number of class sessions is set for a range of grades, instead of for each grade, thus introducing a degree of flexibility for schools (OECD 2013a, Annex 3). In Poland, since 2011/12 the three grades of primary school (for children aged 7 to 9) are organised according to a flexible timetable prepared by one teacher, in which the duration of lessons and breaks are adjusted to the pupils' capabilities. The exceptions are modern foreign languages, musical education, computer science and physical education for which minimum instruction hours are set (OECD 2013a, Annex 3). In 2014, thirteen OECD countries allowed the flexible allocation of instruction time across multiple grades in primary and/or lower secondary education (and in eleven countries this was at both levels of education) (OECD, 2014b, Table D1.2).

International data shed light on the extent to which OECD countries have used changes in instruction time as a central policy lever. For those OECD countries with available data, the total amount of intended instruction time for students aged 7 to 14 has not changed significantly on average over the period 2001 to 2011 (Table A3.1). Over the period 2005 to 2012, the number of hours per year of intended instruction time has slightly decreased on average in the OECD for students in primary education, but remained stable for students in lower secondary education (Figure 3.1). However, there have been substantial changes in the amount of allocated instruction time in both primary and lower secondary education over the period 2008 to 2012 in Denmark, Finland, Iceland, Norway, Poland, Slovenia and Spain (increases) and in the Czech Republic, Israel and Italy (decreases). Estonia and Greece saw substantial decreases in instruction time at both primary and lower secondary levels between 2005 and 2008. In the Czech Republic, Estonia and Greece instruction time is now below the OECD average amount. In both Estonia and the Czech Republic, schools are responsible for the allocation of instruction time within a central framework.

Even if countries do not make significant changes to the overall amount of allocated instruction time, they may reassign the existing amount of instruction time to give greater emphasis to particular learning areas. For example, in 2008 Japan increased the amount of instruction time in mathematics and science at the expense of a reduction in the amount of compulsory flexible curriculum. The rationale for increasing instruction time in these areas was to allow students sufficient time to learn hard-to-understand content and to conduct a sufficient amount of observational and experimental work (OECD 2013a, Annex 3).

The implications of extending instruction time for different stakeholders

The optimal length of instruction time has been debated for many years. In the United States there have been three hundred initiatives to extend instruction time between 1991 and 2007. Educational researchers have identified different potential positive and negative effects of increasing the amount of instruction time for different stakeholders. These relate to both the quality and equity of student learning experiences and outcomes, as well as organisational and time aspects for teachers and parents. Table 3.2 presents a helpful overview by Patall, Cooper and Allen (2010).

Implications for society and families

Political arguments may draw on the potential to improve productivity for both students (who could learn more with greater amounts of instruction time) and parents (who would be able to work longer hours if their children spent more time in educational settings). In recent years, both the United States and the United Kingdom have made political arguments to lengthen the school year based on international comparisons and the need to ensure future economic competitiveness.[2] Increasing instruction time could

2. In April 2013, Michael Gove, the Education Secretary in England (United Kingdom) stated that the school year corresponded to the former demands of an agricultural economy and explained his plans to lengthen

also benefit particular student groups. More instruction time could contribute to equalising chances for children from less advantaged socio-economic backgrounds, who tend to have less resources and less supervision in their out of school time, a condition that can intensify during the summer, bringing greater summer learning loss (Cooper et al., 1996) and higher incidence of risky behaviour (Patall et al., 2010). The costs of increasing instruction time can be justified in as much as they may help to limit future social costs, for example by reducing crime and increasing economic productivity (Brown et al., 2005). However, critics find no solid evidence of crime reduction resulting from instruction time increase and comment that financial resources may be more effectively used in other interventions (Aronson et al., 1998; Levin, Glass and Meister, 1984; Karweit, 1985).

Table 3.2 Potential effects of extending instruction time for different stakeholders

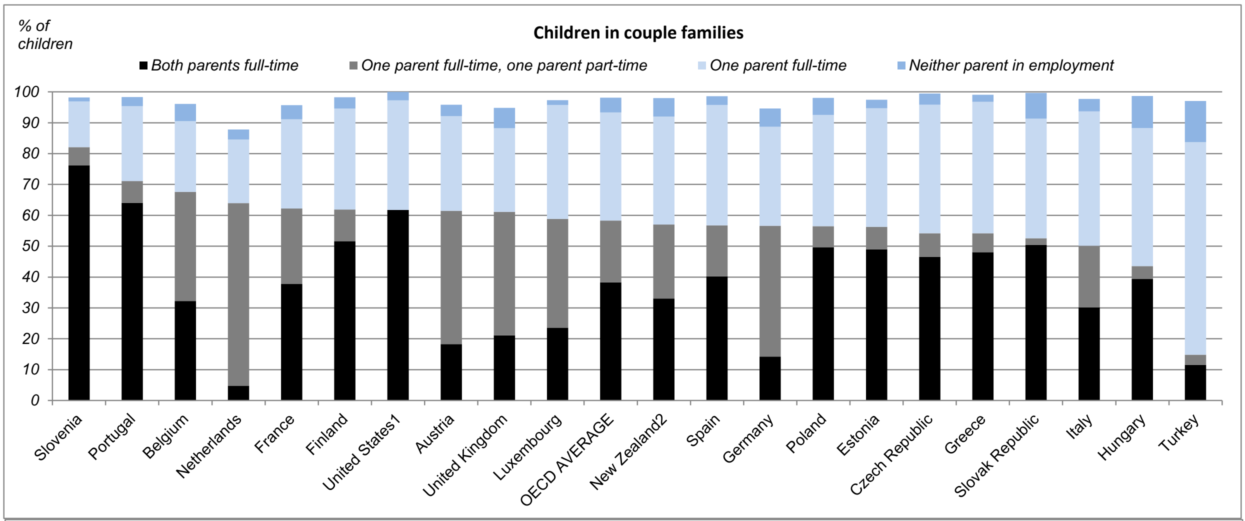
Stakeholder	*Potential positive effect*	*Potential negative effect*
For students	*Increased learning and better academic achievement* *More time for learning; more time on task* *More repetition of material; deeper coverage of the curriculum* *More opportunities for experiential learning* *Deepened adult/child relationships*	*Time wastage (increase in allocated time does not necessarily mean more instruction)* *Increased fatigue and boredom and less effort* *Increased absenteeism and dropout rates* *Less free time and time for other activities or employment*
For educators, instruction and teaching	*More time for instruction and a less hurried pace for covering material*	*Greater number of work hours and less time off* *Teacher and administrator burn out*
For parents	*Lower child care costs* *Easier scheduling and transportation for working parents*	*Child care needs of working parents may still not be met* *May interfere with family vacation and other time*
For society	*Levels the playing field for disadvantaged children* *More learning opportunities for low-income children* *Decreased cost due to reduced need for retention, remediation and other social programmes* *Increased future productivity and earnings* *Reduced crime*	*Cost (staff salaries, facilities and maintenance)* *Takes resources from more effective interventions (e.g. addressing instructional quality)*

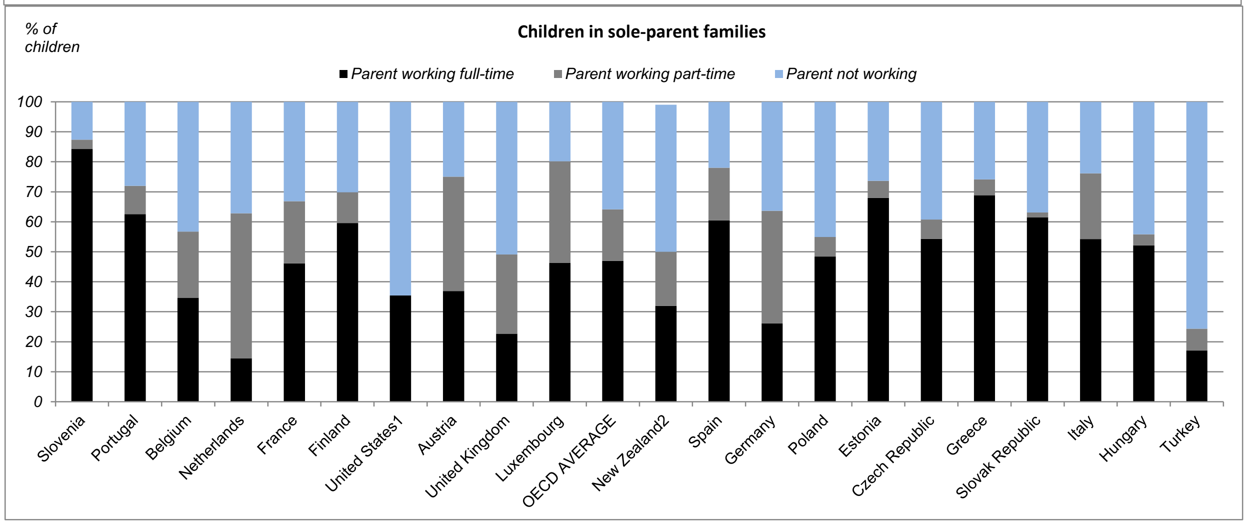
Source: Reproduced from Patall, E., H. Cooper and A.B. Allen (2010), "Extending the school day or school year: A systematic review of research (1985-2009)", Review of Educational Research, 80(3), pp. 401-436.

the school year and shorten the holidays in 2014 in terms or remaining competitive with East Asian economies (www.bbc.com/news/education-22202694). In the United States, President Obama (2009) had previously used a similar argument to frame reforms in terms of future international competitiveness: “We can no longer afford an academic calendar designed when America was a nation of farmers who needed their children at home plowing the land at the end of each day. That calendar may have once made sense, but today, it puts us at a competitive disadvantage. Our children spend over a month less in school than children in South Korea. That is no way to prepare them for a 21st century economy. The challenges of a new century demand more time in the classroom.”

Figure 3.2 Time and economic resources for families

Parental employment status for children aged 0 to 14 years (2010)





Note: Countries are ranked in descending order of percentage of children in couple families where both parents are employed.

1. United States: no distinction between full-time and part-time work. 2. New Zealand: Children under age 18.

Source: OECD (2012b), OECD Family Database, www.oecd.org/social/family/database; for European countries, European Labour Force Surveys 2010; for the United States, U.S. Census Bureau, Current Population Survey, 2008 Annual Social and Economic Supplement; for Japan, 2007 Comprehensive Survey of Living Conditions of the People on Health and Welfare; for New Zealand, 2006 Census of Population and Dwellings.

Extended instruction time also seems to be more compatible in modern societies that have double breadwinner and sole-parent households that may struggle to provide after-school and summer care for their children. According to the most recent census data available, 9% of all OECD households comprise sole-parent families (OECD, 2007a). This represents 20% of all OECD households with children. In terms of parental time resources, on the simple measure of whether or not the parent has some type of employment, the situation is similar for children in sole-parent and couple families: around 60% of children have working parents (Figure 3.2). However, in terms of economic resources, a greater proportion of children in sole-parent families do not have a working parent. Lack of both time and economic resources can lead to more difficulties in organising afterschool time in sole-parent households (McLanahan et al., 1994). Some research has identified different attitudes among parents with different socio-economic status: more affluent parents oppose moves to shorten school holidays as it interferes with their family vacation plans, but less affluent parents tend to perceive long summer holidays as problematic (Silva, 2007); among a sample of more than a thousand American parents, 63% of parents earning below USD 25 000 per year think that their children do not have enough interesting summer opportunities, while 43% of parents earning more than USD 50 000 per year share this view (Duffett et al., 2004). These researchers also identify greater demand from less socio-economically advantaged parents for after-school academic activities.

Implications for students and teachers

For students, the key argument is that extending instruction time is expected to benefit performance. Students would have more time for learning, more time on tasks and less rushed lessons. Teachers can cover the curriculum in more depth and breadth (and not just focus on subjects tested in high-stakes assessments or examinations) which can better correspond to students' interests and present materials with more contextual variety, which is believed by some cognitive scientists to increase students' deeper understanding (Farbman and Kaplan, 2005). More time can allow greater interaction and more positive relationships between teachers and students, which can also benefit academic achievement (Farbman and Kaplan, 2005). Critics of extended instruction time, most prominently Aronson et al., (1998), Levin, Glass and Meister (1984) and Karweit (1985), point out that an increase in the raw amount of instruction time does not automatically translate into more engaged time and actual learning time and, consequently, might prove an inefficient use of resources, given the high cost of such interventions. For them, time, rather than being a guarantor of success, is simply a resource that can be more or less effectively used, depending on the quality of instruction and other factors. Criticism also includes the potential fatigue and boredom of students. A survey of 609 secondary school students in the United States found that only 3% of students perceive that they have too much free time, while 22% feel they are overloaded (Duffett et al., 2004).

Extending instruction time of course has implications for teachers' working conditions. Research cautions on the possible burnout of teachers, especially those working in the year-round schools where there is no longer a long summer break (Cooper et al., 2003). Among other motivations for a teaching career, time for family and longer holidays is one factor that is highly rated among teachers in England and Norway (Kyriacou, Hultgren and Stephens, 1999), in Turkey (Eren and Tezel, 2010) and in the United States (Lortie, 1975). Elam (1989, in Silva, 2007) found that most teachers in the United States opposed a longer school year, even if salaries were raised accordingly. However, a reform to extend school time in California was accompanied by additional pay and extra planning time and was supported by teachers (Gandara, 2000). Farbman and Kaplan (2005), in their case studies on Massachusetts schools, estimated that senior teachers earned up to an additional USD 20 000 a year through extending instruction time by three hours a day. France's largest teaching union advocated for more time for class preparation and new forms of time organisation during the 2013 reform of school rhythms requiring teachers to work four and a half days instead of four days (SNUipp, 2013).

Table 3.3 Changes in mathematics learning time and mathematics performance (PISA 2003 and 2012)

Reported increase between 2003 and 2012	*Countries*	*Did this change more in socio-economically advantaged or disadvantaged schools?*	*Change in observed relationship with performance?*	*Is there a relationship with performance once student and school characteristics are considered?*
90 minutes increase	*Canada, Portugal*	*Greater increase in advantaged schools (although not statistically significant in Portugal)*	*No in Canada (no relationship)* *Yes, more positive in Portugal (weak positive relationship in 2012; none in 2003)*	*No in Portugal* *Yes in Canada (weak negative)*
30 minutes increase	*Spain and Norway*	*No difference*	*Yes, more negative (very weak, negative in 2012; no relationship in 2003)*	*No*
	United States	*Greater increase in disadvantaged schools (although not statistically significant)*	*No (remains a weak, positive relationship)*	*No*
17 to 22 minutes increase	*Belgium, Greece and Mexico*	*Greater increase in disadvantaged schools*	*Yes, less positive (remains weak, positive relationship in Belgium and Greece; very weak in Mexico)*	*Yes (weak positive)*
	Italy and Japan	*Greater increase in advantaged schools (although not statistically significant in Japan)*	*Yes, more positive* *(weak positive relationship in Italy; moderate positive relationship in Japan)*	*Yes (weak positive)*
	Denmark, Finland and Sweden	*No difference*	*No (no relationship with performance)*	*No*
	Netherlands	*Greater increase in disadvantaged schools (although not statistically significant)*	*Yes, more negative (no relationship in 2012; very weak positive in 2003)*	*No*
Decrease of 28 to 32 minutes	*Korea and Turkey*	*Greater decrease in disadvantaged schools (although not statistically significant)*	*Yes, more positive (weak positive relationship in 2003; moderate positive relationship in 2012)*	*Yes (weak positive)*

Note: Other countries where students reported significant increases in mathematics time are Australia and Luxembourg (less than 10 minutes) and the Czech Republic and Germany (around 14 minutes). In the Czech Republic the relationship with performance was less positive (no relationship in 2012; weak positive in 2003), but in other countries there was no change. Other countries where students reported significant decreases in mathematics time are Austria, Poland and Iceland (10 minutes or less), Hungary (13 minutes) and the Slovak Republic (17 minutes). In Poland and the Slovak Republic the relationship with performance was more positive in 2012 and the decrease in time was greater in disadvantaged schools, although not significant in the Slovak Republic. In other countries there was no change in the relationship with performance.

Source: OECD (2013b), PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices, http://dx.doi.org/10.1787/9789264201156-en, Tables IV.1.26, IV.3.47(2) and IV.1.12c.

Effectiveness of marginal changes in the amount of allocated instruction time

Various factors influence the productivity of instruction hours, including the quality of the curriculum and instructional approaches and the effectiveness of the education system overall, which makes it hard to examine the effect of instructional time on student achievement (Mullis et al., 2012b). The majority of effectiveness research concludes that marginal increases in the allocated amount of instruction time have, at best, a very small positive impact on student achievement.[3] However, some studies have shown a substantial relationship between these two variables (Wiley and Harnischfeger, 1974; Kidder, O'Reilly and Kiesling, 1975; Fraser, Walberg, Welch and Hattie, 1987; and Walberg, 1988). Walberg (1988) reviewed more than 100 studies and found that 88% of these showed positive influences of time on learning (Walberg, Niemiec and Frederick, 1994). Wiley and Harnischfeger (1974) studied 6th Grade students in 40 schools in Detroit, Michigan and found that a 24% increase in time allocation lead to gains of more than a third in mathematics and verbal skills. But Karweit’s (1976) analysis of the same data shows that time allocation is no longer statistically significant once differences between urban and rural settings are taken into account.

The subsequent body of research tended to confirm that above a certain threshold, there is little predictable and significant relationship between marginal increases of time and student achievement (Glass, 2002). Smith (1979) researched 70 classes of 6th Grade students and did not find a statistically significant relationship between their school performance and the amount of instruction time to which they were exposed. Brown and Saks (1986) estimated that average elasticities for reading and mathematics of 2nd and 5th Grade students amount to 0.10, meaning that a 10% increase in time would lead to a mere 1% increase in student achievement (but emphasising that the relationship is more pronounced for slower learners). Subsequent reanalysis has shown even smaller elasticities, suggesting even weaker change in student achievement (Levin and Tsang, 1987). Analysis of PISA 2009 results showed that a moderate amount of time in regular lessons had the most positive association with performance (OECD, 2011).

Baker, Fabrega and Galindo (2004) analysed cross-sectional international data to compare the relationship between instruction time and student performance (as measured in OECD’s PISA and IEA’s TIMSS) in almost 40 countries and found no significant relationship. Instruction time in mathematics explained 2.2% of variance in mathematics performance and in most countries there was no relationship, even after accounting for differences in students’ home educational resources. The only countries where there was a substantial relationship between time allocated for mathematics and mathematics achievement (explaining around 10% of variance) were Greece, Korea, Japan and Poland. Scheerens et al., (2013: 1) note that the findings of Baker et al. (2004) confirm those of Husen (1972) and may indicate some trade-off between quality and quantity of instruction, “in the sense that high quality education can, to some degree, compensate for short hours”. In PISA 2012 – as in PISA 2003 – there is no clear relationship between whether students spend more time in regular mathematics lessons and a country’s overall mathematics performance suggesting that cross-system differences in the quality of instruction time blur the relationship between the quantity of instruction time and student performance (OECD, 2013b).[4]

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3. This general finding has emerged from the body of research on the topic, most prominently from the work of Anderson (1983); Baker, Fabrega, and Galindo (2004), Brown and Saks (1986); Caldwell, Huitt and Graeber (1982), Cotton and Savard (1981); Coleman et al. (1966) Fisher and Berliner (1985); Fredrick and Walberg (1980); Honzay (1986-87); Hossler et al. (1988); Husen (1972); Karweit (1976, 1985); Levin and Tsang (1987); Lomax and Cooley (1979); Mazzarella (1984); Smith (1979); Walberg and Tsai (1984) and Walberg (1988).

4. Across OECD countries, the correlation between mathematics performance and average learning time in regular mathematics lessons is -0.30 (significant at the 10% level), but this is mainly because of outliers (OECD, 2013b).

A comparison of results from OECD PISA 2003 and 2012 allows a closer look at how the relationship between instruction time and mathematics performance has changed. While on average in the OECD, 15-year-old students reported 4.1 class periods in mathematics per week in both 2003 and 2012, they reported spending 13 minutes longer learning mathematics in regular lessons. The OECD average increase in mathematics instruction has happened in both socio-economically advantaged and disadvantaged schools. However, a closer look at the data reveals some different patterns among the countries with the greater changes in reported learning time (Table 3.3):

- In Canada, the United States, Denmark, Finland and Sweden, while there are reported increases in mathematics time, there has been no change since 2003 in how time relates to mathematics performance. In Canada, the reported increase is greater among socio-economically advantaged schools (by 45 minutes).
- In Portugal, Italy, Japan (all with increases in time) and in Korea, Turkey, Poland and the Slovak Republic (all with decreases in time), the relationship between time and mathematics performance has become more positive in 2012. In all cases, the gap between reported mathematics time in socio-economically advantaged and disadvantaged schools has widened in favour of advantaged schools, although the difference is only statistically significant in Italy and Poland.
- In Norway, Spain, Belgium, Greece, Mexico, the Netherlands and the Czech Republic, while there are reported increases in mathematics time, the relationship between time and mathematics performance has become more negative in 2012. In Belgium, Greece, Mexico and the Netherlands, the reported increase is greater among socio-economically disadvantaged schools, although the difference in not statistically significant in the Netherlands.

In some of the countries with the highest reported increases in mathematics learning time (Canada, Portugal, Norway and the United States), there is also a high degree of variability of regular mathematics lesson time among schools (Figure A3.2).

How changes in instruction time affect different types of students

Educational interventions tend to have different influence on various groups of students and are "in a systematic way related to the amount of prior family and school investment" (Grissmer, 2002: 97). Arlin (1984) and Grissmer (2002) show that investments in human capital, whether in the form of capital, labour or time inputs, might show diminishing returns. Since disadvantaged students were typically exposed to less educational resources in the past than advantaged students, they argue, newly allocated resources represent a bigger percentage of overall human capital investment for disadvantaged students and, therefore, tend to have more impact on their performance.

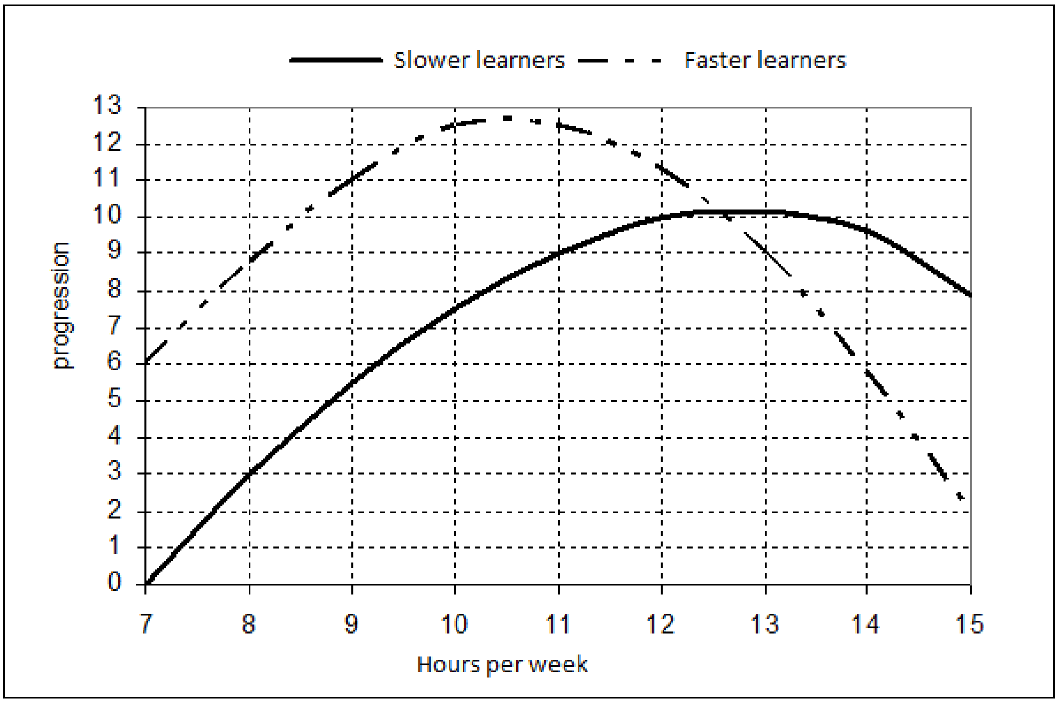
This argument is related to findings that changes in allocation of instruction time tend to have stronger effect on two main subgroups of students: 1) slower learners and low-performing students (Patall et al., 2010; Cotton, 1989; Brown and Saks, 1986) as well as 2) disadvantaged students due to low socio-economic or immigrant background (Mazzarella, 1984; Silva, 2007; Llach, Adrogué and Gigaglia, 2009; Grissmer et al., 2000). These results invite consideration of targeted interventions, such as remedial programmes for slower learners or increasing instruction time in schools with a high proportion of disadvantaged students (OECD, 2012a).

Slower learners and low-performing students

In their overview of student learning time literature, Scheerens et al. (2013) find a strong suggestion that sufficient time is especially important for weaker students. Additional allocations of instruction time have been shown both to increase the performance of slower learners (Cotton, 1989; Brown and Saks, 1986) and to reduce their task-related anxiety (Guida, Ludlow and Wilson, 1985). Bloom (1976) believes that the slowest 10% of learners need up to even 5 to 6 times more time than the fastest 10%, a time that they are usually not given. Estimates of Suchaut (1996, 2009) are less extreme (Figure 3.3). He shows that more time affects children's progress in reading but with a ceiling effect which varies as a function of the initial level of students' aptitude (or the time needed to learn as defined in Carroll's model in Chapter 1). For Suchaut, this ceiling is set at 10.5 hours a week for faster learners and 13 hours a week for slower learners.

Figure 3.3 Estimates of optimal instruction time for slower and faster learners in France

Progress in reading for 6 year-olds



Source: Reproduced from Suchaut, B. (2009), "L'organisation et l'utilisation du temps scolaire à l'école primaire: enjeux et effets sur les élèves", in Conférence à l'initiative de la ville de Cran-Gevrier; Haute-Savoie.

Students with different background characteristics

The slow and unequal process of acquiring language competency seems to be especially dependent on a student's family background. Usually, children who grow up with highly articulate guardians are put at an initial advantage relative to children who do not experience a wealth of language in everyday circumstances (Hirsch, 2006). Hart and Risey (1995) in their longitudinal study that involved recording speech interactions at home, conclude that what children hear at home as toddlers explains most of the variations in their later reading process.

However, OECD's PISA has consistently shown that students from relatively advantaged socio-economic background have more opportunities to acquire knowledge and skills in key areas, particularly in science. Students from relatively disadvantaged socio-economic backgrounds report spending 9.8 hours of instruction time per week on science, mathematics and the language of instruction, while students from relatively advantaged socio-economic backgrounds report spending 11.5 hours per week, representing a weekly difference of 1 hour and 42 minutes: 50 minutes in science, 30 minutes in mathematics and 20 minutes in reading (OECD, 2011).

Lavy (2010) analysed PISA 2006 results and found that the effects of marginal increases of instruction time are 35% higher for students from relatively disadvantaged socio-economic background, when considering the compound difference in scores for reading, mathematics and science. The overall difference was primarily driven by discrepant results in reading, suggesting that students from less advantaged socio-economic backgrounds benefited the most from the additional time in the language of instruction. However, the same study showed a stronger impact of instruction time increases on mathematics and science performance for students with an immigrant background. This was particularly pronounced for second-generation immigrant students (who were born in the country, but who have a least one foreign-born parent) with effects of 69% (Lavy, 2010).

Costs of increasing instruction time

The labour intensive character of the education sector means that the major costs of increasing instruction time relate to the cost of work of different types of personnel multiplied by their time commitments. Across the OECD, salaries of school personnel amount to 79% of the whole budget for non-tertiary education, with 62% remunerating teachers and 17% compensating other staff (OECD, 2013a). All other expenses, including facilities and equipment, are only 21% of the education budget. At the same time, increasing instruction time may lead to savings for parents and the community and open up further possibilities to participate in the labour market for parents. As Levin (1988) ascertains, many analyses of educational cost are incomprehensive because they estimate the cost incurred by a particular actor, usually the government, omitting the high subsidies that are not borne directly by a decision maker but by parents or the community.

Costs of increasing instruction time vary substantially both within and across countries. Most estimates come from the United States where the issue has been especially popular and where the costs of public elementary and secondary education in the school year 2009/10 amounted to USD 607 billion (U.S. National Center for Education Statistics, 2012). Given the enormous expense of some of the proposed interventions, it comes as a surprise that so few studies estimate the per-student cost of suggested changes (Hummel-Rossi and Ashdown, 2002).

Costs of extending the school year

In the United States, the seminal report *A Nation at Risk* recommended extending the school year from 180 to 210 instruction days (National Commission on Excellence in Education, 1983). Odden (1983) estimated that increasing the allocated time by 11% (that is from 180 to 200 instruction days or from 6 to 8 daily instruction hours) would cost the exchequer more than USD 20 billion in 1980s dollars or USD 40 billion in 2000 dollars. To put this amount into perspective, the sum exceeds the 2011 budget of the United States Department of Justice (White House, 2012). In 1998, Aronson et al. estimated that the introduction of one additional six-hour day per year to all public schools in the United States would cost USD 1.1 billion nationally, ranging from USD 2.3 to USD 121.4 million per state depending on its population and characteristics. A 2013 reform in France extends the school year in primary education from

141 to 180 days, but keeping the same total amount of allocated instruction time (see Box 2.1). This entails a reorganisation and extension of existing local authority provision of student non-instructional activities and as such was accompanied by a one-off budget of EUR 250 million to provide initial support to local authorities.

Costs of extending the school day

Studies have found non-linearities in the increase of instruction time and the costs entailed (Silva, 2007; Farbman and Kaplan, 2005). This is due to the fact that some costs are held constant, e.g. overhead costs, while others increase disproportionately slower to the increases in instruction time, e.g. costs related to the maintenance of buildings. Silva (2007) estimates that on average a 10% increase in instruction time is accompanied by a 6 to 7% increase in costs. Prolonging the school day is usually cheaper than prolonging the school year. Running a school for an additional hour each day generates only limited increases, if any, in the costs of maintenance of facilities or transport of students. Also, adding extra hours of instruction per day to teachers' time commitment has proven cheaper than adding extra days. Farbman and Kaplan (2005) in their case studies of schools in Massachusetts showed that prolonging the school day by three hours meant an average increase of annual costs by USD 1 200 per student with senior teachers earning annually up to an extra USD 20 000. On average, the per-student cost increased by 7 to 12% for a rise in instruction time of 15 to 45%.

While comparative international data on costs for providing additional lessons after school hours or extra-curricular activities do not yet exist, there are indications that these are wide spread and, in many countries, managed at the school level:

- According to PISA 2012 results, just over a quarter of students in the OECD on average report spending some time attending after-school lessons in their language of instruction (27%) or science (26%) each week; and 38% report spending time in after-school mathematics lessons (OECD, 2013b, Table IV.3.25). On average in the OECD, 66% of students are in schools where additional mathematics lesson are offered (Table A3.2). In 26 OECD systems, criteria exist to pay teachers a supplementary amount (either on an annual or incidental basis) for teaching more classes or hours required than by full-time contract; such criteria are most typically set by schools (in 16 OECD systems), but may also be set by local, regional or central authorities (Table A3.2).

- In Chile, Denmark, Estonia, Israel, Poland, Portugal, Spain and Turkey, lower secondary teachers are required to spend time working on extra-curricular activities (Table A3.2); but this is at the discretion of schools in 11 other OECD systems. On average in the TALIS 2013 survey, teachers reported spending 2 hours in the past week on extra-curricular activities (OECD, 2014a, Table 6.12). Among the OECD systems with available data where responsibility for allocating time for extra-curricular activities lies with the schools, teachers in the Flemish Community of Belgium, the Czech Republic and the Netherlands report spending an average of 1.3 hours per week, teachers in England an average of 2.2 hours, teachers in Korea an average of 2.7 hours and teachers in the United States an average of 3.6 hours (Table A3.2).

- With regard to creative extra-curricular activities, such as music, art or drama, PISA 2012 results indicate that more socio-economically advantaged schools offer more creative extra-curricular activities (OECD, 2013b).

Cost effectiveness of instruction time

The estimated costs are considerable and would be justified, were marginal increases of instruction time a strong contributor to improvement of student achievement (Levin and Tsang, 1987; Glass, 1984; Levin and Glass, 1987). Very few studies analyse the cost-benefit aspect of recommended interventions (Hummel-Rossi and Ashdown, 2002). Scheerens et al. (2013) found no studies on the cost effectiveness of regular school learning time.

Table 3.4 Comparative cost and effectiveness of increasing instruction time (Levin, 1986)

Estimated cost and effectiveness of four educational interventions in months of additional learning gain per year of instruction (costs expressed in 1986 USD)

			Annual cost (per student per subject in 1986 USD)	Effectiveness (in months of achievement gain)	
				Mathematics	Reading
More instruction time			61	0.3	0.7
Computer-assisted Instruction			119	1.2	2.3
Cross-age tutoring with peers			212	9.7	4.8
Cross-age tutoring with adults			827	6.7	3.8
	From	To			
Reducing class size	35	30	45	0.6	0.3
	30	25	63	0.7	0.4
	25	20	94	0.9	0.5
	35	20	201	2.2	1.1

Source: Reproduced from Levin, H. M. (1986), "Are longer school sessions a good investment?", Contemporary Economic Policy, 4(3), pp. 63-75.

Analysis of efficiency presupposes that increasing the amount of instruction time should be assessed against other uses of resources, both within and outside the education sector (Levin and Tsang, 1987). The underlying assumption is that increasing instruction time for students would be efficient if it increased achievement at a lower cost than alternative solutions, such as increasing teacher salaries, reducing class size or improving curriculum. The best known analysis of cost-effectiveness comes from the work of Levin and his colleagues (1984, 1987) who researched the effects on mathematics and reading attainment of four different interventions: 1) increasing instruction time; 2) reducing class size; 3) introducing computer-assisted learning; and 4) organising tutorials. In their research, increase of instruction time turned out to be a comparatively ineffective intervention (Table 3.4). In terms of its impact on student performance, allocating more instruction time per day was the single least effective intervention for mathematics and, after reducing class size, the second least effective intervention for reading.

Once the cost component was introduced, the difference in efficiency of different interventions became even more pronounced than the difference in effectiveness. Increasing instruction time was shown as the single least efficient approach for improving results in mathematics, remarkably, nine times less cost-effective than peer-tutoring (Table 3.5). It was also the third least efficient approach for improving results in reading (after reducing class size and introducing tutoring by adults), turning out to be two times less cost-effective than peer tutoring. Levin and Tsang (1987: 363) concluded their investigation by saying "both the analytic and empirical results suggest extreme caution in viewing increased instructional time as an efficient method for increasing student achievement". This corresponds to conclusions of Baker et al. (2004: 331) who ascertained that "Even class size, which is recognised as a non-complex resource that becomes significant only in connection with many variables, is a more potent, stand-alone resource than instructional time".

Table 3.5 Comparative efficiency of increasing instruction time (Levin, 1986)

Estimated annual cost of obtaining additional month of learning gain per year of instruction (costs expressed in 1986 USD)

			Costs (in 1986 USD)	
			Mathematics	*Reading*
More instruction time			*203*	*87*
Computer-Assisted Instruction			*100*	*52*
Cross-Age Tutoring with peers			*22*	*44*
Cross-Age Tutoring with adults			*123*	*218*
	From	*To*		
Reducing class size	*35*	*30*	*75*	*150*
	30	*25*	*90*	*158*
	25	*20*	*104*	*188*
	35	*20*	*91*	*183*

Source: Reproduced from Levin, H. M. (1986), "Are longer school sessions a good investment?", Contemporary Economic Policy, 4(3), pp. 63-75.

Summary and implications

The allocation of instruction time is an important central policy lever across the OECD countries. However, the allocated instruction time for students aged 7 to 14 has not changed significantly on average in the OECD over the period 2001 to 2011. But some OECD countries have used this policy lever over the period 2005 to 2012: Denmark, Finland, Iceland, Norway, Poland, Slovenia and Spain have increased instruction time in both primary and lower secondary education, whereas the Czech Republic, Estonia, Greece, Israel and Italy have decreased this. The most significant changes have been seen in Estonia, Greece and also in the Czech Republic at the primary level. In all cases, the allocated amount of instruction time is lower than the OECD average. In the Czech Republic this corresponds to the introduction of a minimum instruction time allocation with more flexibility at the school level to organise both minimum and additional instruction hours. Many OECD countries have introduced a higher degree of flexibility for schools to organise time scheduling either with greater autonomy generally or with more flexibility in central guidelines.

Although the major argument to increase instruction time is to increase students' opportunity to learn, which is expected to lead to improved performance, there are arguments to provide longer instructional days and/or to increase the number of instructional weeks to help address societal and economic changes, primarily to fit the needs of children with working parents, in sole-parent families and in less socio-economically advantaged families. Around 60% of children in the OECD have working parents and 20% are in sole-parent families. Extending instruction time of course has implications for teachers' working conditions and teachers in different countries have voiced the importance of having sufficient time for planning and class preparation.

A body of research shows the importance of allocating sufficient instruction time for students to learn, but that increasing instruction time alone is not sufficient to bring about major performance improvements. The relationship between instruction time and student performance is complex and indicates that the quality of instruction time is as important, if not more important, than the quantity. It also appears to be subject to diminishing returns. However, some students are slower learners than others and do benefit from more learning time, as do students with an immigrant background and students in schools with higher concentrations of students from less advantaged socio-economic backgrounds. Increasing the allocated instruction time for these particular student groups is expected to have a greater impact on their performance. However, in some OECD countries student reports on the time they spend learning mathematics indicate that the gap has widened in favour of students in more socio-economically advantaged schools between 2003 and 2012.

The analysis in this chapter presents limited information on the costs of increasing allocated instruction time. Decisions to increase allocated instruction time do increase costs, but not in a linear way due to fixed overhead costs for infrastructure. The major implications for costs are the related increases in staff costs to provide additional instruction. Prolonging the school day is more affordable than prolonging the school year. One comparative analysis by Levin (1986) demonstrates that the relatively weak effect of increasing instruction time on student performance makes this a comparatively inefficient intervention once costs are considered and compared with other interventions.

CHAPTER 4: THE EFFECTIVE USE OF ALLOCATED INSTRUCTION TIME

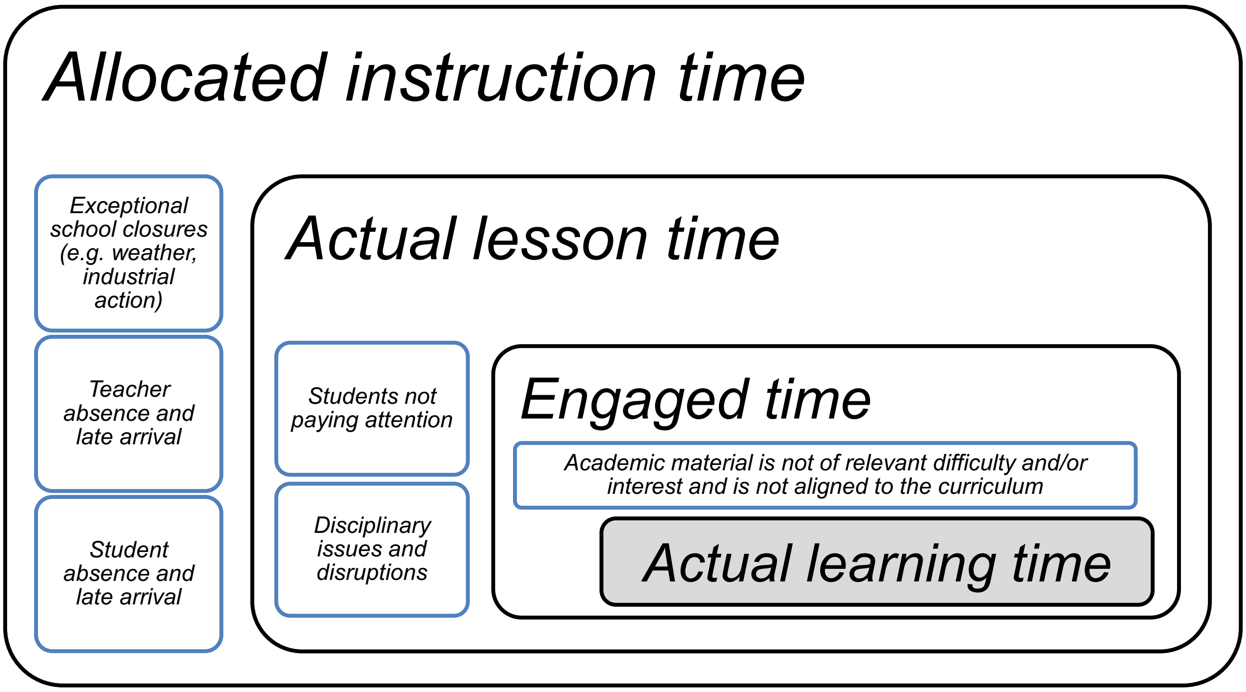
This chapter presents a model for understanding the effective use of allocated instruction time and examines evidence on how effectively instruction time is used in OECD countries.

A model for understanding the effective use of allocated instruction time

Instructional time loss should be an important concern for those who finance education (Abadzi, 2007). There are different ways that the intended amount of instruction time – as specified in policy documents – is lost (see Figure 4.1). There may be exceptional factors that lead to periodic school closure (e.g. severe weather, strikes) and also teacher-related factors and student-related factors that reduce the intended or allocated instruction time.

Many researchers believe that above a certain threshold further increases in instruction time tend to have limited impact on performance because they may not be effectively used (Silva, 2007; Funkhouser et al., 1995; Aronson et al., 1998). More instruction time will only be impactful if meaningfully translated into "engaged time" and "actual learning time" (Figure 4.1).

Figure 4.1 Model for understanding the effective use of allocated instruction time



Engaged time is a proportion of actual instruction time during which students are judged to be paying attention. Actual learning time is a complex and individual measure. Essentially, this reflects Carroll's (1963) basic variable of student aptitude or time needed to learn and the fact that this varies from student to student (Figure 1.1). As such, it introduces elements of instructional differentiation and quality into the time equation and also the notion of relevance of the content to which students are exposed, e.g. whether it is suitably challenging and sufficiently aligned to the curriculum.

The effective use of regular school time and performance

Scheerens et al. (2013) examined a series of meta-analyses of studies conducted between 1985 and 2005 on learning time and found that the effective use of regular school time has a small to moderate positive effect on student achievement in mathematics and reading (Table 4.1). Compared to other factors, extra time is an important condition to enhance educational effectiveness through the "increase of well-targeted exposure to content" (Scheerens et al., 2013). They conduct their own meta-analysis of studies published between 2005 and 2011 and find very small positive effects (roughly a third of the estimated effect sizes of the earlier studies). One hypothesis is that the more recent studies are of higher technical quality. Earlier studies use a mix of different time definitions, from statutory time, official school hours or teaching hours to more efficient use of teaching time, time on task and "quality time", as such some of the time effects may be confounded with aspects of teaching quality.

Table 4.1 Overview of meta-analyses of student learning time

Meta-analysis conducted by	*Definition of time*	*Mean effect size (Cohen's d)*	*Mean effect size (Correlation coefficient r)*	*Number of studies*	*Number of replications*
Fraser et al., 1987	*Instructional time*	*0.36*	*0.18*	*7827*	*22155*
	Engaged time	*0.83*	*0.38*		
	Time on task	*0.88*	*0.40*		
Scheerens et al., 2007	*Learning time*	*0.31*	*0.15*	*30*	*111*
Creemers and Kyrakides, 2010	*Quantity of teaching*	*0.33*	*0.16*	*18*	
Hattie, 2009	*Time on task*	*0.38*	*0.19*	*100*	*136*
	Decreasing disruptive behaviour	*0.34*	*0.17*	*165*	*416*
Marzano, 2000	*Classroom management*	*0.52*	*0.25*	*100*	

Note: Cohen's d effect sizes should be interpreted as small (0.20), moderate (0.50) and large (0.80) and correlation coefficient r should be interpreted as small (0.10), moderate (0.30) and large (0.50) (Cohen, 1969). Excluding the outlier of Fraser et al. 1987, the mean effect size for the meta-analyses in Table 2.X expressed as coefficient d is 0.37.

Source: Reproduced from Scheerens, J. et al. (2013), Productive Time in Education, University of Twente, Enschede.

In general, many researchers agree that more refined measures of student learning time have a stronger relationship to performance than just allocated instruction time (e.g. Table 4.1). This fits in with general school effectiveness research showing that factors closer to the classroom have a stronger relationship with student performance than more distant factors (e.g. Scheerens and Bosker, 1997; OECD, 2005). As part of the Alaska School Effectiveness Project, Cotton and Savard (1981) reviewed thirty five studies that measured the relationship between time and learning and concluded that the relationship becomes stronger as more qualified measures of time are used. A small positive relationship was found between instruction time and academic performance, the relationship became stronger for engaged time, while actual learning time emerged as the strongest predictor of achievement among all measures of student learning time. Actual learning time has been shown to have a positive influence on both academic achievement and students' attitudes towards learning (Cotton and Savard, 1981; Karweit, 1985; Mazzarella, 1984). The increase in actual learning time seems to be both effective and efficient because it tends to increase student performance while saving a scarce resource of instruction time (Walberg, 1988).

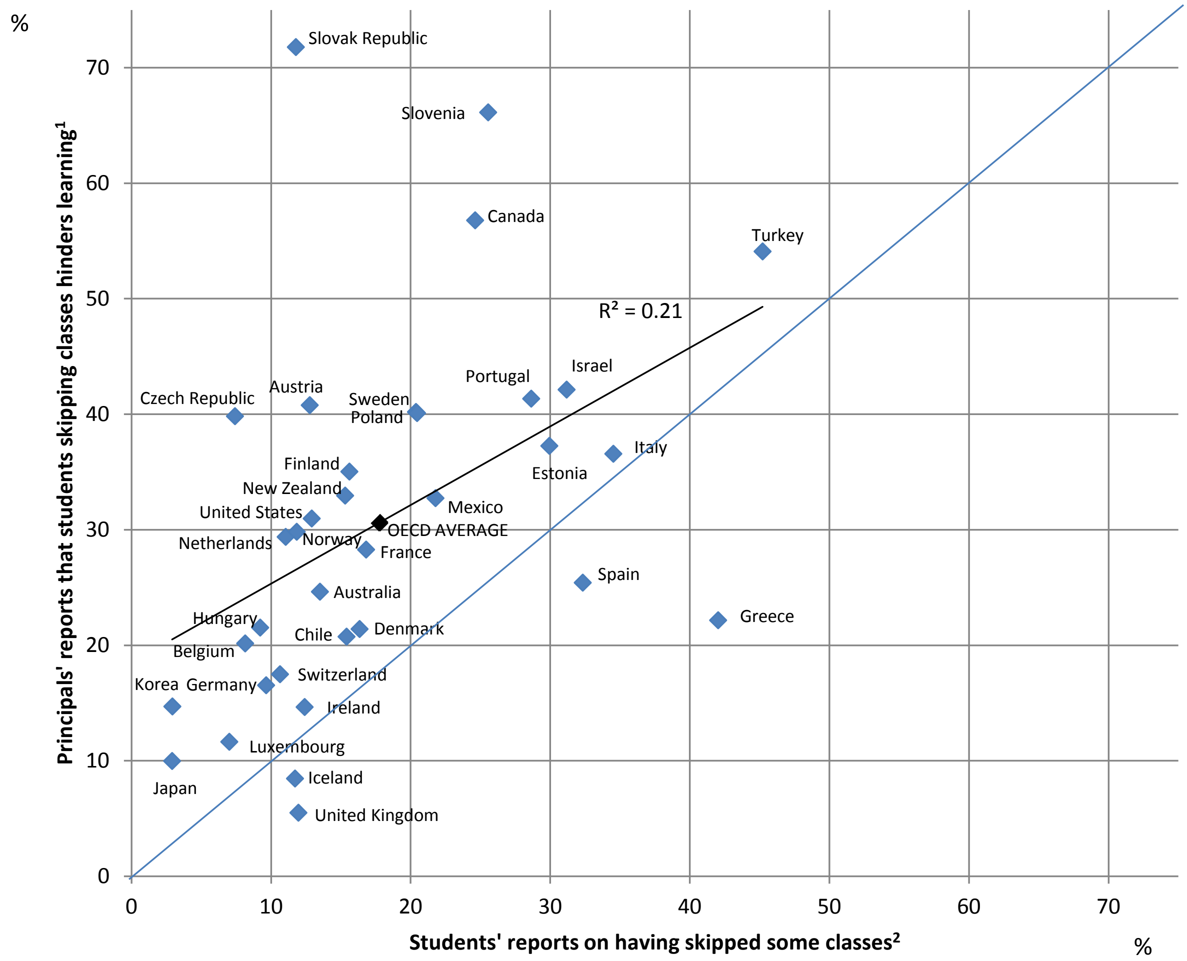
Evidence on the proportion of time that is actually used for instruction

In general, teacher-related factors are not reported to be a significant source of lost instruction time in OECD countries. On average in the OECD, over 90% of students who sat the PISA 2012 test were in schools whose principals reported that teachers being late or not well enough prepared for classes had no or very little impact on instruction (OECD, 2013b, Figure IV.5.7). However, teacher absenteeism reportedly does impact on instruction in many OECD countries: 40% of students in the Netherlands, 30% in Norway and Germany, and between 20 and 26% in Austria, Belgium, Chile, Israel and Sweden.

Teacher absenteeism was one factor examined in a 2006-07 study in the Netherlands conducted in 96 secondary schools and/or auxiliary branches (OECD, 2007b, Box D1.1). On average, 6.7% of the lessons at the sampled schools were cancelled, ranging from 5% to 9% across schools. 43% of cancellations were due to teacher illness and 47% due to either teacher leave or participation in professional development. Only 1.2% of the cancelled lessons had replacement or substitute teachers. Together with insufficient school-level timetabling of instructional hours, this was found to contribute to only 81% on average of minimum instruction time being achieved in the lower years of the sampled secondary schools. There may be a lack of qualified substitutes to replace absent teachers (OECD, 2001). Teacher shortage is related to the school's disciplinary climate (OECD, 2013b, Table IV.5.13) which, as shown below, is an important indicator of lost instruction time in regular school lessons.

Studies that have focused on explaining students' achievement *growth* rather than their absolute score (Summers and Wolfe, 1975; Kean, Summers, Raivetz and Farber, 1979) identified student absence from school as the only time-related variable that was statistically significant. Even when accounting for income and achievement, attendance showed a substantial relationship, with 10 days more of presence being equivalent to a half of a month of growth (Summers and Wolfe, 1975). Of course, absenteeism is a complex problem that may be related to variables such as low motivation or poor health. Absenteeism and time spent on task significantly influence student performance and they are related with other negative outcomes such as school drop-out rates, delinquency and drug abuse (e.g. Baker et al., 2001; Lee and Burkam, 2003; McCluskey et al., 2004; Wilmers et al., 2002 in OECD, 2013c). Research on students' individual preferences for when they feel most alert and ready for learning (see Box 4.2) has revealed that this may be linked with absenteeism and indicates that it may be especially important for students at risk to match instruction time with their preferred learning times. Multilevel analysis of PISA 2012 results shows that school systems granting more discretion to schools to determine curricula and assessment policies tend to be those with fewer students who skip school (OECD, 2013b, Figure IV.1.23).

Figure 4.2 Lost instruction time: Students skipping class (PISA 2012)



Notes:

1. Y axis: Percentage of students in schools whose principals reported that students skipping classes hinders student learning "to some extent" or "a lot".

2. X axis: Percentage of students who reported having skipped some classes at least once in the two weeks prior to the PISA test.

Source: OECD (2013b), PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices, http://dx.doi.org/10.1787/9789264201156-en.

Student absenteeism appears to be more common in some OECD countries than in others. International data from 1995 show differences in rates of student absenteeism in Grade 8 (typically ages 13 to 14) across countries as reported by school principals (OECD, 2000, Indicator D5). Reported rates of student absence from school on a typical day for any reason were lowest in Korea, Japan, the Flemish Community of Belgium, Iceland, the Netherlands, Spain, Norway and Denmark; and highest in Scotland, the Czech Republic, Ireland, Australia, New Zealand, England, the French Community of Belgium, the United States and Canada. In most countries, this was associated with negative performance in the Third International Mathematics and Science Study (TIMSS). The most recent international data (from PISA 2012) also reveals cross-country differences in the percentage of students reporting they had skipped school and that systems with higher percentages of students who skip school tend to score lower in the PISA mathematics assessment. After accounting for per capita GDP, differences in percentages of students reporting they had skipped school explain 16% of the variation in mathematics performance across OECD countries (OECD, 2013b, Figure IV.1.22).

International data also indicate that the phenomenon of lost instruction time via student absence is more widespread in some countries than in others. The percentage of Grade 8 students enrolled in schools whose principals reported a daily student absenteeism rate of 5% or more ranged from under 5% in Japan and Korea to over 75% in Australia, the Czech Republic, Ireland, New Zealand and the United Kingdom (OECD, 2000). The most recent international data (from PISA 2012) show some striking similarities. The proportion of students in schools where 10% or fewer students reported they had skipped a day or class at least once in the two weeks prior to the PISA tests was over 90% in Japan and Korea, but less than 10% in Australia, Canada, Estonia, Greece, Israel, Italy, Mexico, New Zealand, Portugal, Slovenia, Spain, Sweden, Turkey, the United Kingdom and the United States (OECD, 2013b, Table IV.5.4).

Box 4.1 presents some policy approaches being used in Australia.

Box 4.1 Strategies to address student absenteeism in Australia

Evidence on patterns of student attendance and how these relate to performance

In 2012, the Australian government commissioned a study on patterns in student attendance and how these relate to their performance. The study was conducted in the state of Western Australia using enrolment and attendance data collected by schools and results from the Australian full-cohort National Assessment Program – Literacy and Numeracy (NAPLAN) over the period 2008 to 2012. Data for over 415 000 students in Years 1 to 10 were compiled, representing primary and lower secondary education. The attendance rates of students in Western Australia were highly consistent with published attendance data for students in other Australian states and territories. The study examined differences between authorised (e.g. due to illness) and unauthorised (either unexplained or where the school principal does not accept the reason given for absence) absences from school.

While student attendance is a complex issue, the study presents several fey findings and implications for policy:

- *Attendance rates were consistently high (around 92%) and stable in primary education, but declined markedly from the first year of lower secondary education (Year 8).*
- *Start attendance initiatives in early years and focus on disadvantaged students: Students with some measure of relative disadvantage (in lower socio-economic schools, with less well educated parents, highly mobile and changing schools, or from the Aboriginal community) were more likely to have poorer attendance rates in Year 1 and these disparities become wider in lower secondary education. More advantaged children had relatively high achievement levels irrespective of their attendance at school, particularly in primary education.*
- *Encourage parental awareness of the importance of attending school: average academic achievement on NAPLAN tests declined with any absence from school and continued to decline as rates of absenteeism increased. Absence from school was also related to academic achievement in subsequent years.*
- *Focus on reducing unauthorised absences: unauthorised absences (even small amounts) had a significantly stronger association with achievement than authorised absences and are likely to reflect behavioural and school engagement issues. There were distinct gaps in unauthorised absences between more and less advantaged students.*
- *Encourage parents and provide support through schools to help students catch up after missing school: By Year 3, there are significant achievement gaps for disadvantaged students. Improvements in absence rates (particularly unauthorised) over time, protected students from falling further behind and in some cases were related to improvements in NAPLAN results in later years.*

The Remote School Attendance Strategy

The Australian Government is providing AUD 46.5 million to engage School Attendance Officers to work with parents and remote indigenous communities in the Northern Territory, Western Australia, South Australia, New South Wales and Queensland. The strategy is designed to be community driven, with the Officers working to encourage school attendance through a variety of measures such as: walking or driving children to school; helping with lunch preparation and organising uniforms; developing and facilitating playgroups and after-school activities; working with families to address poor attendance rates; rewarding improved attendance; and working with the school to monitor attendance and follow-up on student absences. The Officers, who are locals, also work within their communities to promote the benefits of regular school attendance.

Example of a remote school offering a flexible school year

Gunbalanya School is located in the Kunbarllanjnja community, approximately 320km east of Darwin in the Northern Territory. Road access via 4 wheel drive is only possible in the dry season. During the wet season, from December to May, Gunbalanya is completely cut-off from the rest of Australia. Gunbalanya School provides education for approximately 210 students from preschool to middle years. Enrolment and attendance at Gunbalanya School are variable, with highest attendance during the wet season and lower during the dry season when people are most mobile. To accommodate students' education requirements along with their customs Gunbalanya School has rearranged its school calendar to align more closely with the indigenous calendar allowing students and families to undertake traditional ceremonies during the dry season with longer holiday breaks, and commencing school three weeks earlier in the wet season. The changes mean students can keep their cultural commitments without missing valuable school time.

Further information: https://www.dpmc.gov.au/indigenous-affairs; http://www.indigenous.gov.au/gunbalanya-schools-semester-changes-boost-attendance; and https://www.youtube.com/watch?v=U-XHftXOx0Y.

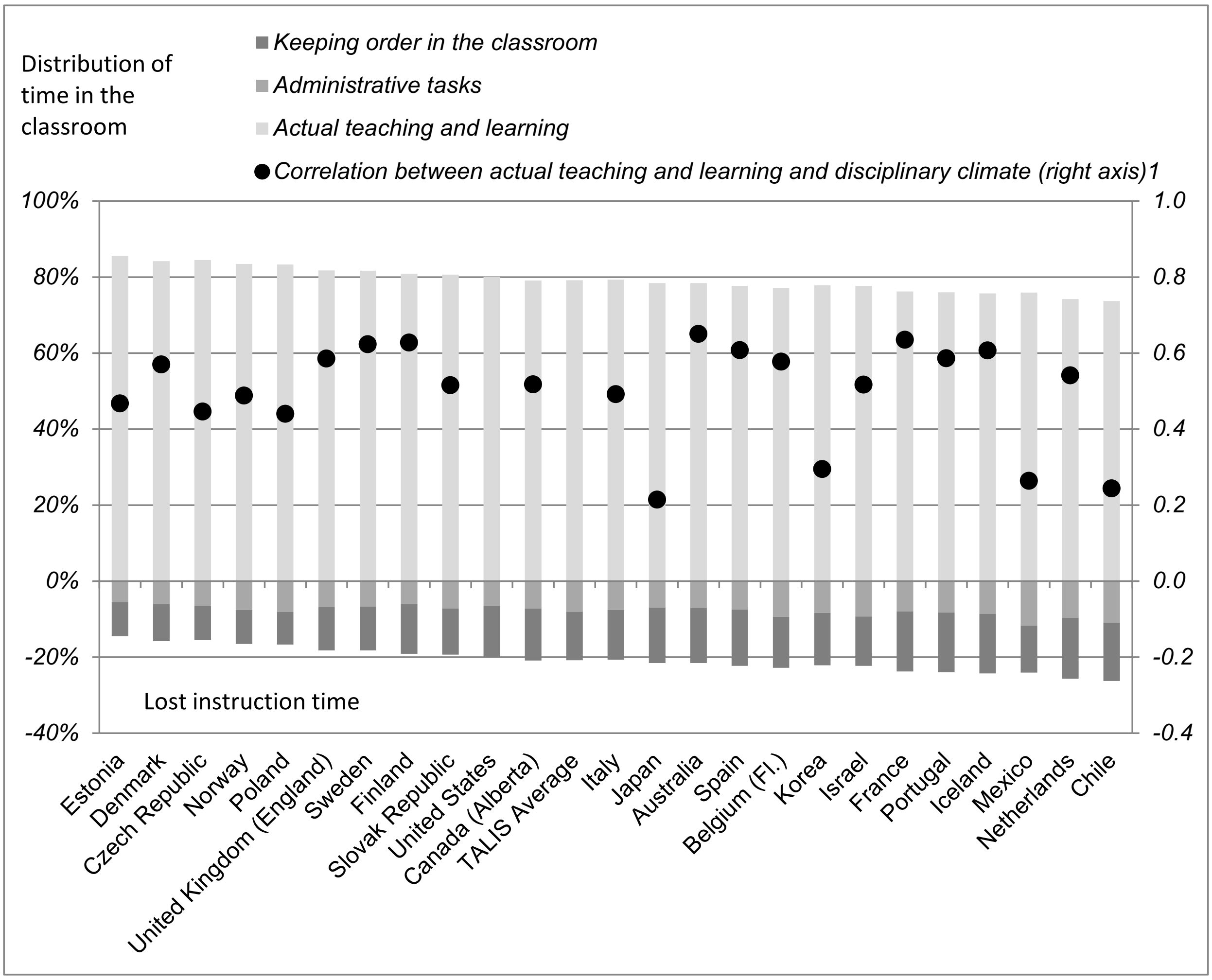
Source: Hancock, K. J. et al. (2013), Student attendance and educational outcomes: Every day counts, Report for the Department of Education, Employment and Workplace Relations, Canberra.

Even when present at school, students may also limit their use of the allocated instruction time by skipping classes or arriving late (OECD, 2013b). International data indicate a substantial amount of lost time in terms of students skipping classes (Figure 4.2). On average in the OECD, 18% of students in PISA 2012 reported that they had skipped class at least once in the two weeks prior to the PISA test; and 31% are in schools whose principal reported that students skipping classes was a factor that hindered learning to some extent or a lot. The proportion of students reporting lost time varies enormously among OECD countries: in Turkey and Greece over 40% of students; in Italy, Spain, Israel and Estonia between 30 and 35% of students; and in Japan, Korea, Luxembourg, Belgium and Germany 10% or fewer students (Figure 4.2). A higher concentration of students arriving late for school was linked with a significant performance disadvantage at the school level in both PISA 2003 and 2012. In fact, the performance disadvantage was more pronounced in 2012, with students in a school where at least 25% of students reported arriving late scoring on average 26 points less than students in other schools, compared to 18 points less in 2003 (OECD, 2013b, Table IV.1.29).

Evidence on the proportion of time when students are actually engaged in learning

Engaged time or time devoted to actual instruction during which students are paying attention is found to have a stronger relationship with student performance than overall allocated instruction time (Caldwell et al., 1982; Frederick and Walberg, 1980; Fraser et al., 1987). While instruction time did not have a stronger effect size than factors such as feedback or homework, engaged time was much more important in predicting student achievement (Fraser et al., 1987). Research from the United States identifies significant gaps between the amount of allocated instruction time and the amount of engaged time (Box 4.2). This may be an important factor in explaining why increases in the total amount of allocated instruction time do not tend to bring proportionate improvements in performance (Chapter 3). The more effective use of allocated instruction time by limiting lost instruction time would appear to be an important priority.

Figure 4.3. Distribution of time spent in the classroom during an average lesson (2013)



Note: 1. Correlations for the United States and the TALIS average are missing.

Source OECD (2014a), TALIS 2013 Results: An International Perspective on Teaching and Learning, http://dx.doi.org/10.1787/9789264196261-en, Tables 6.20 and 6.22.

Sleepiness is one factor that can contribute to a lack of attention. International data from PIRLS and TIMSS 2011 reveal that on average 46% to 49% of Grade 4 students, depending on the subject (language, mathematics or science), had teachers who reported that students suffering from a lack of sleep was limiting some or a lot of instruction; and this was 57% to 58% of students in Grade 8 (Mullis et al., 2012a; Mullis et al., 2012b; Martin et al., 2012). Again, these reports varied considerably among countries, with, for example, student sleepiness much more commonly reported by teachers in France and the United States. Also, teacher reports in some countries indicated that the greater incidence of sleepiness for older students was particularly pronounced, for example in Finland.

Box 4.2 Estimates of engaged and actual learning time in the United States

A body of research from the United States during the 1970s, 1980s and 1990s produced a number of estimates of the amount of time students are engaged in learning. Despite considerable differences in estimates, virtually all studies suggest that there is ample room for improvement of the use of already allocated instruction time (Levin, 1986) and indicate a general phenomenon of scarcity of effective instruction time. If as little as half of the allocated time can be devoted to actual instruction (Gettinger and Seibert, 2002), increasing the effectiveness of the existing time emerges as one of the time-related educational priorities. Hossler et al. (1988) believe that even up to 70% of teachers need improvement in their skills of class management.

Estimates of time lost for non-instructional purposes

Estimates of engaged time, or time devoted to actual instruction during which students seem to pay attention, vary tremendously by state, region, classroom and measurement method (Hossler, Stage and Gallagher, 1988; Karweit and Slavin, 1981). It is estimated that elementary school instruction time used for non-instructional purposes ranges from 20% (Rosenshine, 1980) to more than 50% (Kane, 1994). The field research of Brady et al. (1977) shows that elementary school children are engaged for approximately 60% of time during instruction in mathematics and reading. Out of the resulting loss of 40% of time, almost half is believed to be due to transitions and issues of class management (Fisher, 1978).

According to Aronson et al. (1998), the National Education Association estimated that engaged time accounts for 28% to 56% of time spent at school in a given year. Berliner (1984) assessed that children are actively engaged in learning for 40% of the total amount of time they spend at school on an average day, which is very close to Karweit's (1985) estimate of 38%. Anderson (1983), Fredrick et al. (1979) and Seifert and Beck (1984) say that when only instruction time is concerned, approximately half of it qualifies as engaged time with the other half being spent on procedural and disciplinary matters, transitions, off-task activities, socialising and many others (Cotton, 1989). In Canada, Noonan (2002) estimates that around 50 hours of allocated time are annually lost due to disruptions, such as class interruptions.

Estimates of how actual learning time varies among students

Actual learning time, or time during which students work on academic material of relevant difficulty that allows them to experience success, seems to be even a scarcer resource than engaged time. The Beginning Teacher Evaluation Study, an American research programme between 1972 and 1978 on teaching behaviours that are conducive to learning, estimated that actual learning time makes for approximately a half of the engaged time (Fisher, 1978; similar estimates were made by Caldwell et al., 1982).

Caldwell et al. (1982) identify stark individual differences in aptitude and ability to concentrate and to focus on instruction among students in the same grade, with estimates that actual learning time in reading among Grade 2 students can range from 3 to 42 minutes a day. They create different learner profiles that show differences in attendance (an average-low elementary student attends 150 out of 180 annual school days creating an initial loss of 17% of allocated instruction time; an average-high elementary school student attends 170 out of 180 days, initially losing only of 5% of instruction time) and also stark differences in estimates of actual learning time (an average-low elementary student can experience as little as 30 out of 360 hours in language and 10 out of 135 hours in mathematics; the actual learning time estimates for average-high elementary students are 224 hours and 90 hours respectively). These estimates suggest pronounced differences between students at both ends of the achievement distribution.

Werner and Simpson (1974) over a 30-day period measured the attention span of children at the start of elementary school using three different learner groups as identified by teachers. Poorly adjusted learners could focus their attention for 66% of time allocated to tasks, moderately adjusted learners for 81% and well-adjusted learners for 88%. The proportion of work done correctly by each learner group was closely related: 69%, 82% and 88%, respectively. The researchers identified great individual differences in ability to focus even before the proper start of compulsory education. Bell and Davidson (1976) in their observations of twenty three primary school teachers and 462 students found variations in how time on task related to achievement in teacher-administered tests (an average correlation of 0.25 ranging from -0.14 to 0.64).

Box 4.3 Students' preferred learning times

There are considerable differences in individual chronobiological rhythms, that is, the body clock and its 24 hour cycle of varying energy levels. These influence the learning process, with different students following different cycles of alertness and fatigue. Biggers (1980) examined different levels of alertness and identified subgroups of morning-active individuals and evening-active individuals. Students in these different subgroups would prefer morning or afternoon and evening learning, accordingly.

Preferred learning times and student performance

Some researchers find that students who prefer learning in the afternoon or evening show weaker performance in the morning. In Bigger's (1980) study, the 39% of high school students who favoured afternoon or evening learning scored significantly lower than other students on morning tests. Although 42% of students in Bigger's study did not report a preferred learning time, those who reported a preference for the morning graduated from high school with, on average, half a grade score higher than other students. Andrews' (1990) study in the 5th grade found that the majority of underachievers were afternoon learners. Callan (1999) measured the influence of students' time-of-day preference on performance in algebra tests. In the morning tests, students with morning preference performed statistically significantly above students with afternoon or evening preference, but not significantly different from students who reported no preference or late-morning preference.

However, some research finds only a minority of students who prefer morning learning among the strongest performers. Dunn and Dunn's (1993) study identified 70% of students as non-morning people and found that very few of the students preferring morning were among either the weakest or strongest performers. Milgram, Dunn and Price (1993) studied gifted students in Brazil, Canada, Egypt, Guatemala, Israel, Korea, the Philippines and the United States and identified that less than 10% of these preferred learning in the morning.

Preferred learning times and the timing of instruction and testing

Some research provides evidence that matching the time of instruction with students' time-of-day preference can improve academic performance (Biggers, 1980; Virostko, 1983; Callan, 1999). Virostko (1983) attempted to study the effects of matching instruction time to students' preferred learning times. In a two year study of 296 students in grades three to six, students were offered one subject (either English or mathematics) at their preferred time and the other at their non-preferred time. At the end of the first year, students scored significantly better in the subject studied at their preferred time as tested in the official New York State tests. In the second year, students who were offered mathematics at their preferred time during the first year were offered English at their preferred time in the second year and vice versa. The results showed that 98% of students scored better in the new subjects offered at their preferred time than they did in the previous year.

Lynch (1981) recommended adjusting school schedules to address the needs of students with preferences for late-morning and afternoon learning. Also, students preferring evening learning should be taught how to productively study at home. Individual differences in vigilance might be especially significant in tests that influence the future academic path of students, such as the United States' Scholastic Achievement Tests (SATs) that are administered early in the morning (Callan, 1999; Dubocovich et al., 2005).

Preferred learning times and student absenteeism

It may be especially important for students at risk to match instruction time with their preferred learning times. Some research indicates that preferred learning times are linked with student attitudes towards school (Andrews, 1990; Dunn and Dunn, 1993). Campbell and Stanley (1963) argued that matching instruction time with student preferred learning times had stronger influence on attendance rates than the choice of teachers. Lynch's (1981) study of students in the 11th and 12th Grades revealed that the truants were almost exclusively students who expressed preference for afternoon or evening learning. As part of the study, these students were offered English classes later in the day and this significantly reduced their number of absences and increased their scores. Gadwa and Griggs (1985) reached similar conclusions during their study identifying that high school drop-outs mostly preferred learning in the evening and showed difficulties with morning learning.

International data from 2008 indicate that teachers report spending around 80% of their lesson time on teaching and learning (Figure A4.1). However, teacher reports also show that valuable teaching time is lost through disruptions and administrative tasks and that in most countries one in four teachers report losing at least 30% of their lesson time to these factors (OECD, 2009). The most recent international data (from TALIS 2013) offers a very similar picture. Teachers report spending around 80% of class time on teaching and learning, 8% on administrative tasks and 12% on keeping order in the classroom (Figure 4.3).

In many countries the actual teaching and learning time is strongly correlated with the disciplinary climate in the classroom. This was observed in both 2008 and 2013 TALIS surveys in Australia, Portugal and Spain (Figures A4.1 and 4.3); in 2013 in Finland, France, Iceland and Sweden; and in 2008 in Estonia, Hungary and Ireland (although in Estonia the correlation was less strong in 2013). The better the classroom disciplinary climate, the more time spent on actual teaching and learning. Unlike other features of classroom instruction, there is a high level of agreement about the importance of classroom discipline among teachers, students and observers (Clausen, 2002 in OECD, 2009). Results from all PISA surveys consistently show that a more positive disciplinary climate is positively related to student performance. In PISA 2012, a more positive disciplinary climate was related to better school average performance in 48 of the participating countries and economies, even after accounting for student and school socio-economic profiles and other school characteristics (OECD, 2013b, Table IV.1.12c).

In many countries the actual teaching and learning time is strongly correlated with the disciplinary climate in the classroom. This was observed in both 2008 and 2013 TALIS surveys in Australia, Portugal and Spain (Figures A4.1 and 4.3); in 2013 in Finland, France, Iceland and Sweden; and in 2008 in Estonia, Hungary and Ireland (although in Estonia the correlation was less strong in 2013). The better the classroom disciplinary climate, the more time spent on actual teaching and learning. Unlike other features of classroom instruction, there is a high level of agreement about the importance of classroom discipline among teachers, students and observers (Clausen, 2002 in OECD, 2009). Results from all PISA surveys consistently show that a more positive disciplinary climate is positively related to student performance. In PISA 2012, a more positive disciplinary climate was related to better school average performance in 48 of the participating countries and economies, even after accounting for student and school socio-economic profiles and other school characteristics (OECD, 2013b, Table IV.1.12c).

Evidence on individual differences in actual learning time

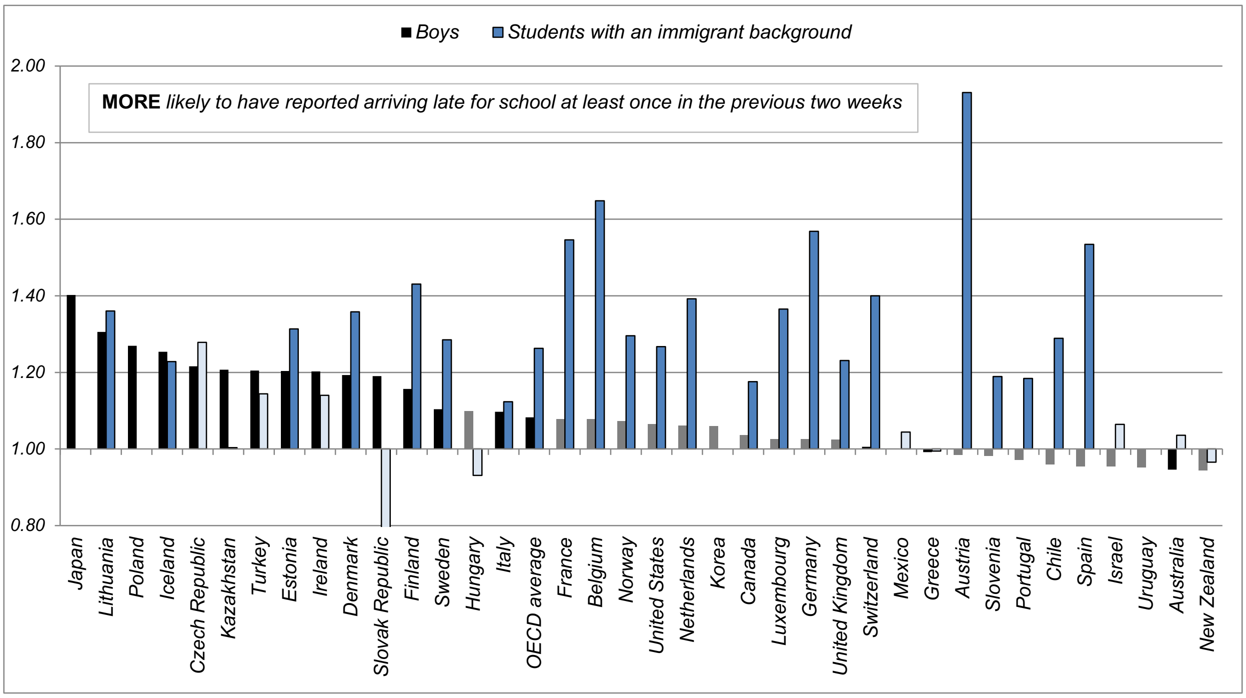
Importantly, research from the United States indicates that different students experience time loss to different degrees (Box 4.1). Beyond varying rates of absenteeism, while present in class and during engaged periods, different students may experience different amounts of actual learning time. As explained above, this may be a function of student aptitude and quality or appropriateness of instruction as defined in Carroll's learning time model (Figure 1.1). Research by Berliner (1990) would define this as "academic learning time", that is, the portion of allocated time, during which the student is engaged and succeeding at what he is doing and what he is doing is related to desirable outcomes.

However, some research on variations in human body clocks also indicates that students may be able to maximise their actual learning time at different times of the day (Box 4.3). There is a risk of a vicious circle for students with relatively shorter actual learning time periods, as this may mean they fall behind in learning and further limit the time during which they may be able to experience success. Dubocovich et al. (2005) argue that it would be logical to conduct the most demanding activities, such as sitting examinations or learning new and challenging material, during the periods when students experience relatively higher levels of alertness. The phenomenon of lost instruction time for different types of students.

There are higher risks for initial losses of allocated instruction time, due to student absence and late arrival, for some students than for others (e.g. Hancock et al., 2013). Some research links higher student absenteeism with learners who express a preference for afternoon or evening learning (Box 4.2). International data from PISA 2012 show higher risks of boys arriving later for school in many countries (Figure 4.4). But the greater risks appear to be for students with an immigrant background, who, on average in the OECD, are 1.2 times more likely to have reported arriving late for school at least once in the two weeks prior to the PISA test. These greater risks for students with an immigrant background are particularly pronounced in Austria, Belgium, Germany, France and Israel. Arriving late for school is also strongly related to the phenomenon of skipping school or classes (OECD, 2013b).

There are also greater risks for lost instruction time during regular school lessons due to poorer disciplinary climates for students from less advantaged socio-economic backgrounds. As in earlier PISA assessments, PISA 2012 results show that socio-economically disadvantaged students are less likely to be in orderly classrooms than advantaged students (OECD, 2013b).

Figure 4.4 Arriving late for school, by gender and immigrant background (PISA 2012)



Note: Statistically significant differences are printed in darker colours. In Japan, Korea, Poland and Uruguay there is a negligible population of students with an immigrant background and therefore results are not shown.

Source: OECD (2013b), PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices, http://dx.doi.org/10.1787/9789264201156-en, Table IV.5.15.

Evidence on how the organisation of instruction time varies at the school level

As noted in Chapter 3, many OECD countries allow a high degree of flexibility for schools in how to organise instruction time, albeit against a central framework of minimum instruction hours. In 2011 on average in the OECD, at age 15, 14% of the compulsory curriculum is flexible, 11% is for mathematics, 12% is for science and 14% is for reading, writing and literature (OECD, 2013a, Table D1.4j). Depending on the OECD country, students at age 15 could be studying at either the lower secondary or upper secondary level and may be in a range of different grades. Consistent with previous PISA surveys, in 2012 reports by 15-year-old students indicate a greater degree of variability in learning time in regular science lessons, compared to time spent in regular mathematics or language-of-instruction lessons (e.g. OECD, 2011; OECD, 2013b). In schools offering greater amounts of instruction time in regular lessons, students tend to perform better (OECD, 2011; OECD, 2013b).

According to reports by 15-year-old students in the OECD's PISA 2012, in many OECD countries there is a high degree of variability in the organisation of instruction time with regard to number of class periods per week (Figure A4.2). On average in the OECD, 15-year-old students report 30 class periods in a normal full week of school, but this has a standard deviation of 7 hours.[5] While in some countries, there is limited variability in reported number of class periods by 15-year-old students (Greece, Spain, Poland, Czech Republic, Slovak Republic and Hungary), in other countries student reports indicate a high degree of variability in total class periods (Chile, United States, Mexico, Israel, France and Korea; Uruguay and Kazakhstan). This does not appear to be entirely linked to differences in the proportions of students enrolled in different grades at age 15 in each country. For example, in both Korea and Greece around 95% of students are enrolled in Grade 10; in Spain, France and Chile around 66% of students are enrolled in Grade 10.

Organising instruction time more effectively at the school level

Research has identified an important role for better time use at the school level. More effective time management, promoted by adequate professional development, has been shown to improve class management and the quality of instruction (e.g. Denham and Lieberman, 1980; Aronson et al., 1998). Cotton and Savard (1981) highlighted the importance of keeping mismanaged time, or time during which students are not expected to do anything, to a minimum. Increased and efficient time use allows greater depth and breadth in all curriculum areas (Walberg, Niemiec and Frederick, 1994).

Cotton (1989) summarises suggestions for teachers and administrators on how to use more effectively allocated instruction time (Table 4.2). Wherever possible, teachers should reduce transition times and non-instructional activities and also choose learning tasks that allow students to experience success. For administrators, in addition to specific time management training for teachers, Cotton suggests policies to decrease student tardiness and absenteeism and also to limit disruptions, as disciplinary actions and interruptions had been found to be negatively related with student achievement (Cotton and Savard, 1981). Results from PISA 2012 support these policies. First, they point to the importance of good relations between teachers and students, as students with equal mathematics performance and similar socio-economic status who reported better student-teacher relations at their school were less likely to have reported arriving late at school (OECD, 2013d). Second, they highlight the important link between levels of student absenteeism and late arrival for school and student performance. Lower rates of absenteeism and better punctuality are two factors, among others, identified in "resilient students in PISA", those who are disadvantaged, but achieve at high levels (OECD, 2013d). Third, student disruptions, as measured in disciplinary climate in PISA 2012, remain strongly linked with student performance even after accounting for student and school socio-economic factors and may highlight the importance of ensuring that better teachers are attracted to schools with less advantaged student intake (OECD, 2013b).

Evidence from the OECD's TALIS 2008 survey shows that new teachers reported greater time loss through less positive disciplinary climates in their classrooms compared to experienced teachers in all participating OECD countries except Korea, Mexico and Turkey (Jensen et al., 2012, Table 2.A.5). At the

5. This means that around 70% of students report within a range of 7 hours more or less than the average of 30 hours, i.e. between 23 and 37 hours.

same time, on average there was no difference in the socio-economic composition of the classes taught by new teachers and experienced teachers (Jensen et al., 2012, Table 2.A.3). Such results call into question whether initial teacher education is adequately preparing new teachers in classroom management skills. Further, they indicate that within a school, reducing the amount of teaching time for new teachers and increasing that for experienced teachers would improve the effective use of allocated instruction time (Jensen et al., 2012). This could allow new teachers to further develop their classroom management skills. When asked about their priority areas for professional development, 25% of new teachers reported classroom management skills, compared to 12% of experienced teachers, and 32% of new teachers reported student discipline and behaviour problems, compared to 20% of experienced teachers (Jensen et al., 2012, Table 3.A.14).

Table 4.2 Suggestions for more effective use of allocated instruction time

Suggestions for teachers
Begin and end lessons on time. *Reduce transition time between tasks.* *Closely monitor student learning and behaviour, including placing students in desk arrangements that allow teacher and students to see one another well from different points in the classroom.* *Establish and follow simple, consistent rules regarding student behaviour in the classroom.* *Make certain that students understand what is expected of them and how to measure its accomplishment.* *Select learning tasks resulting in high levels of success.* *Employ objective feedback about the correctness of responses and assignments and provide suggestions for revision of work products or thought processes.* *Require frequent responses and samples of work, including assigning, collecting, and grading homework regularly.* *Cover content as fully as possible.* *Pay attention to the degree of match between curriculum and testing.* *Reduce non-instructional activities whenever possible.*
Suggestions for administrators
Make certain that the amounts of time allocated to various curricular subjects truly reflect the relative values placed on these subjects by school staff and community members. *Encourage in-service activities to help teachers learn to use time more effectively.* *Encourage parents to teach respect for teachers and for schooling as a means to reducing time-consuming disciplinary actions.* *Establish clear school policies about tardiness and absenteeism and make certain these are enforced.* *Keep loudspeaker announcements and other interruptions of class time to a minimum.*

Source: Reproduced from Cotton, K. (1989), "Educational time factors", School Improvement Research Series (SIRS), Close-Up 8, Northwest regional Educational Laboratory, Portland.

Organising learning time differently has been identified as a potential way to improve educational outcomes for disadvantaged children (OECD, 2012a). The OECD’s project on Innovative Learning Environments has identified innovative ways of using time at the school level. Rescheduling learning, along with regrouping educators, regrouping learners, changing pedagogical approaches and using a mix of pedagogical approaches (including direct teaching), is an important dimension of organisations dynamics to achieve a more complex and flexible organisation of learning (OECD, 2013e). Innovations to organise learning into fewer, longer periods enhance the opportunities for deeper learning, as well as allow greater flexibility. A more flexible use of time can accompany the use of individual student learning plans to better address individual student learning needs. Schools using virtual e-classrooms have removed the notion that learning has to take place at a fixed time and deliberately organise teaching and learning outside the standard hours. At the same time, rituals are important to help structure the school day and to make it more meaningful.

Summary and implications

When allocated instruction time is used effectively, this is an important condition to improve student learning and achievement. However, there is ample evidence that a significant proportion of allocated instruction time is lost in many OECD countries. There are stark differences among OECD countries in reported levels of student absenteeism, which have been observed in international assessments since the mid-1990s and this lost student learning time explains some of the performance differences among OECD countries.

Initial losses of allocated instruction time via teacher absenteeism are generally limited in OECD countries, but have a spill over effect on lost instruction time due to weaker disciplinary climates. Teacher reports in different OECD countries show that valuable teaching time is lost through disruptions. Poorer disciplinary climates have been consistently associated with lower student performance. Within OECD countries, higher concentrations of students arriving late in a school tend to be related to lower school achievement. All such instruction time losses limit the potential amount of engaged time during school lessons – the learning time which research has shown to have a moderate, positive impact on student performance.

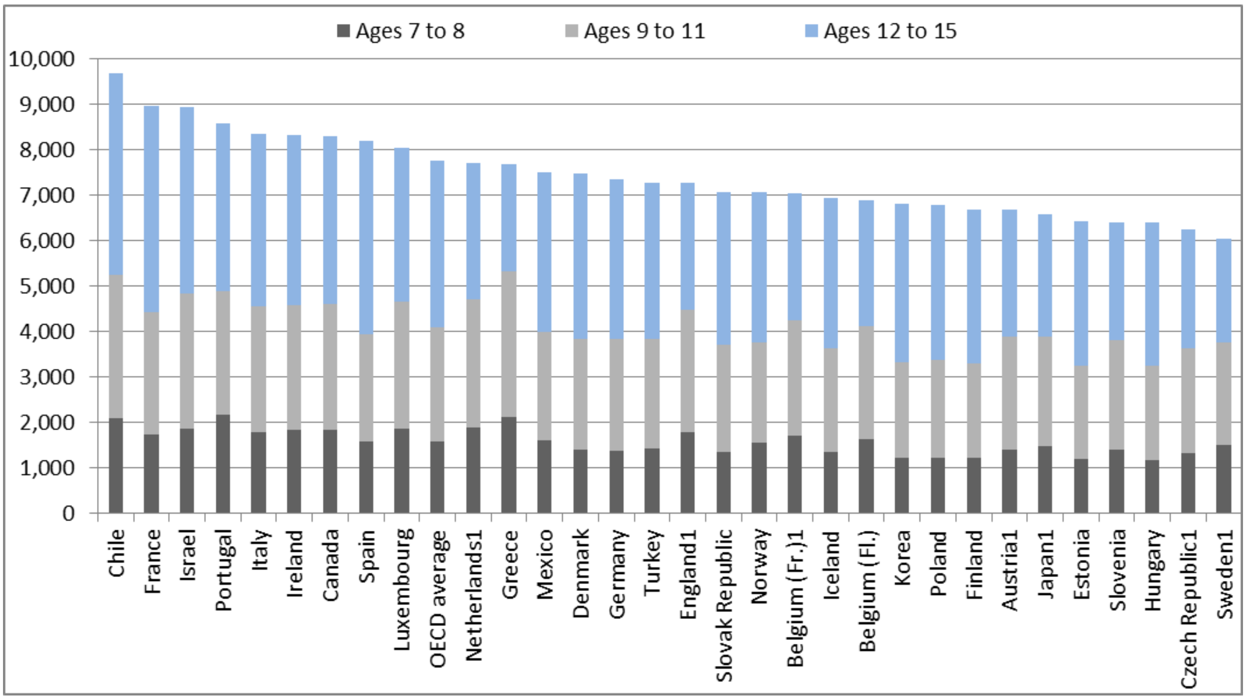
Different students experience time loss to different degrees. Some students may be more receptive to learning in the afternoon or evening and work more effectively at these times. However, there are generally higher risks that students from less advantaged socio-economic background, students with an immigrant background and male students lose greater amounts of allocated instruction time.

Given the cost of adding instruction hours (Chapter 3) and the evidence on how allocated instruction time is lost, the analysis in this chapter allows two key inferences for policy makers: the imperative seems to be to ensure that allocated instruction time is used more effectively; any further increases in allocated instruction time would be most meaningful if accompanied by increased quality of instruction and classroom management. The evidence points to a need to pay adequate attention to classroom management techniques in initial teacher education and professional development activities. This means ensuring that the maximum proportion of instruction time is translated into engaged time. Actual learning time is a complex and individual measure requiring innovative ways to address the learning needs of different students. The greater degree of flexibility in many OECD countries for schools to organise instruction time would seem a helpful condition to help schools meet this challenge.

ANNEX 1

Figure A3.1 Total amount of intended instruction time in 2014

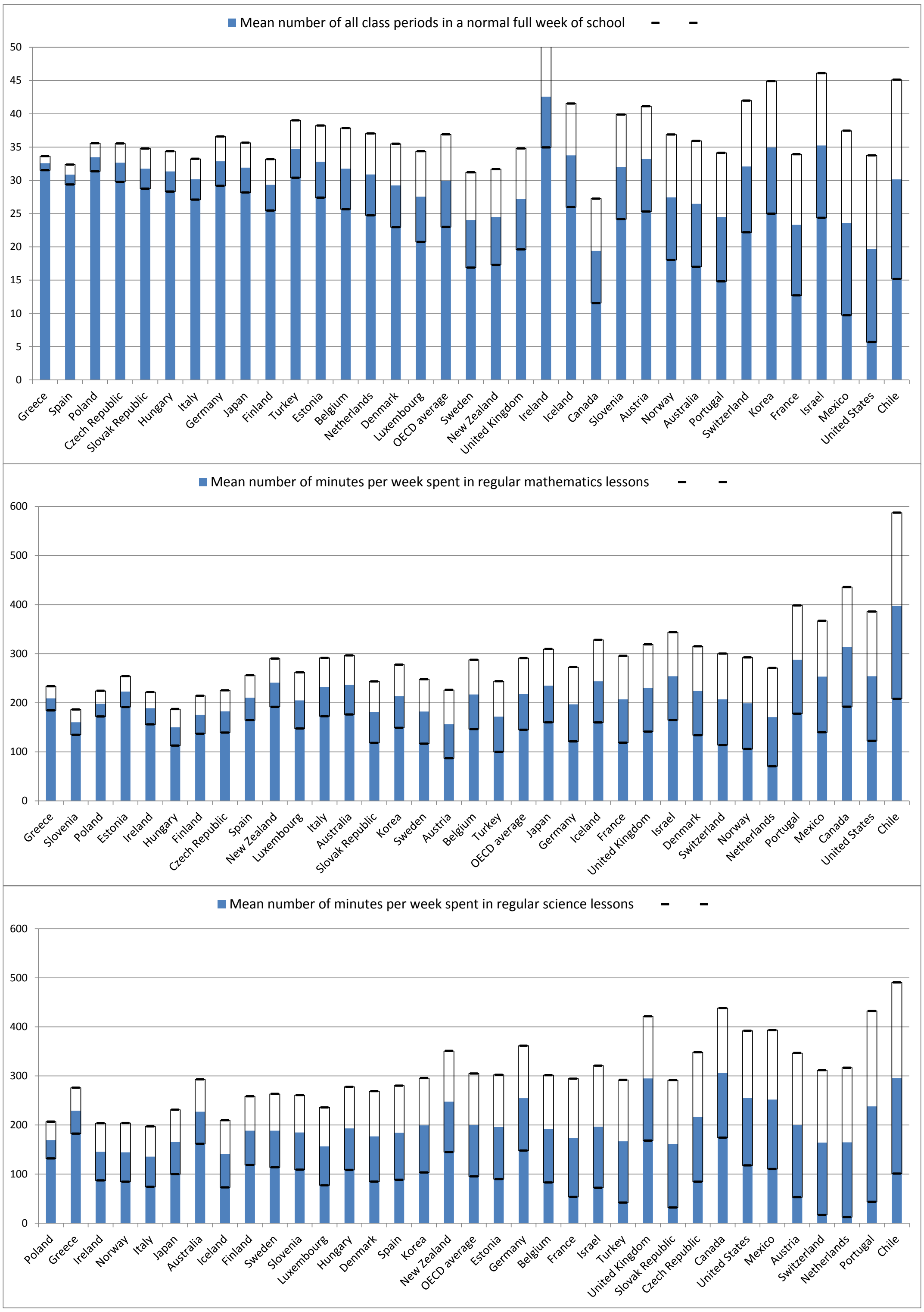
For children aged 7 to 15 in public institutions



Note: 1. Compulsory instruction time data is used for the Netherlands, England, the French Community of Belgium, Austria, Japan, the Czech Republic and Sweden.

Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en. Table D1.4.

Figure A3.2 Variability in learning time as reported by 15 year-old students in PISA 2012



Source: OECD (2013b), PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices, http://dx.doi.org/10.1787/9789264201156-en, Table IV.3.21.

Table A3.1 Total intended instruction time in 2001 and 2011

	Age range at which over 90% of the population are enrolled (2011)	Number of hours per year of total intended instruction time (2011)			Age range at which over 90% of the population are enrolled (2001)	Number of hours per year of total intended instruction time (2001)			Change in number of hours per year of total intended instruction time (2011 - 2001)		
		Ages 7-8	Ages 9-11	Ages 12-14		Ages 7-8	Ages 9-11	Ages 12-14	Ages 7-8	Ages 9-11	Ages 12-14
OECD											
Australia	*5 - 16*	*1983*	*2985*	*3031*	*5 - 16*	*1890*	*2838*	*3098*	*94*	*148*	*-66*
Austria	*4 - 16*	*1470*	*2435*	*2875*	*5 - 16*	*1357*	*2498*	*2991*	*113*	*-63*	*-116*
Belgium (Fl.)	*3 - 18*	*1661*	*2492*	*2864*	*3 - 17*	*1661*	*2492*	*2864*	*0*	*0*	*0*
Belgium (Fr.)	*3 - 18*	*1860*	*2790*	*2040*	*3 - 17*	*1860*	*2790*	*3195*	*0*	*0*	*-1155*
Canada	*6 - 17*	*1834*	*2765*	*2770*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
Chile	*6 - 16*	*1938*	*3249*	*3363*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
Czech Republic[1]	*5 - 17*	*1170*	*2106*	*2574*	*5 - 17*	*1316*	*2310*	*2691*	*-146*	*-204*	*-117*
Denmark	*3 - 16*	*1403*	*2438*	*2700*	*4 - 15*	*1230*	*2250*	*2670*	*173*	*188*	*30*
England	*4 - 16*	*1786*	*2698*	*2774*	*4 - 15*	*1780*	*2670*	*2820*	*6*	*28*	*-46*
Estonia	*4 - 17*	*1216*	*1991*	*2231*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
Finland	*6 - 18*	*1217*	*2049*	*2487*	*6 - 17*	*1083*	*1995*	*2394*	*134*	*54*	*93*
France	*3 - 17*	*1728*	*2692*	*3360*	*3 - 17*	*1670*	*2505*	*3115*	*58*	*187*	*245*
Germany	*4 - 18*	*1283*	*2379*	*2660*	*6 - 17*	*1284*	*2363*	*2633*	*-1*	*17*	*28*
Greece	*5 - 17*	*1440*	*2436*	*2387*	*6 - 16*	*1632*	*2784*	*3192*	*-192*	*-348*	*-805*
Hungary	*4 - 17*	*1228*	*2171*	*2656*	*5 - 16*	*1221*	*2352*	*2775*	*7*	*-181*	*-119*
Iceland	*3 - 16*	*1600*	*2667*	*2907*	*4 - 16*	*1260*	*2077*	*2427*	*340*	*590*	*480*
Ireland	*4 - 18*	*1830*	*2745*	*2786*	*5 - 16*	*1830*	*2745*	*2696*	*0*	*0*	*89*
Israel[1]	*4 - 16*	*1856*	*2977*	*2943*	*5 - 17*	*1888*	*2970*	*2913*	*-32*	*7*	*30*
Italy	*3 - 16*	*1782*	*2772*	*2959*	*3 - 15*	*1938*	*3060*	*3060*	*-156*	*-288*	*-101*
Japan	*4 - 17*	*1467*	*2391*	*2598*	*4 - 17*	*1418*	*2284*	*2625*	*50*	*107*	*-27*
Korea	*6 - 17*	*1195*	*2040*	*2550*	*6 - 17*	*1224*	*2153*	*2601*	*-29*	*-113*	*-51*
Luxembourg[2]	*4 - 15*	*1848*	*2772*	*2700*	*5 - 15*	*1694*	*2541*	*2346*	*154*	*231*	*354*
Mexico	*4 - 14*	*1600*	*2400*	*3500*	*6 - 12*	*1600*	*2400*	*3500*	*0*	*0*	*0*
Netherlands[3]	*4 - 17*	*1880*	*2820*	*3000*	*4 - 16*	*1880*	*3000*	*3200*	*0*	*-180*	*-200*
New Zealand	*4 - 16*	*m*	*m*	*m*	*4 - 15*	*1970*	*2955*	*2845*	*m*	*m*	*m*
Norway	*3 - 17*	*1407*	*2340*	*2516*	*6 - 17*	*1140*	*2109*	*2480*	*267*	*231*	*37*
Poland[2]	*6 - 18*	*1235*	*2202*	*2345*	*6 - 17*	*1274*	*2124*	*2406*	*-39*	*78*	*-61*
Portugal	*5 - 17*	*1830*	*2710*	*2851*	*5 - 15*	*1750*	*2683*	*2713*	*80*	*27*	*139*
Scotland	*4 - 16*	*a*	*a*	*a*	*4 - 15*	*2000*	*3000*	*3000*	*a*	*a*	*a*
Slovak Republic	*6 - 17*	*1368*	*2394*	*2565*	*6 - 16*	*1358*	*2351*	*2681*	*11*	*43*	*-116*
Slovenia	*5 - 18*	*1241*	*2164*	*2451*	*m*	*m*	*m*	*m*	*m*	*m*	*m*
Spain	*3 - 16*	*1750*	*2625*	*3150*	*4 - 16*	*1584*	*2376*	*2797*	*166*	*249*	*353*
Sweden	*3 - 18*	*1481*	*2222*	*2222*	*6 - 18*	*1481*	*2222*	*2222*	*0*	*0*	*0*
Switzerland	*5 - 17*	*m*	*m*	*m*	*6 - 16*	*m*	*m*	*m*	*m*	*m*	*m*
Turkey	*6 - 13*	*1728*	*2592*	*2538*	*7 - 12*	*1728*	*2592*	*2660*	*0*	*0*	*-122*
United States	*6 - 16*	*m*	*m*	*m*	*5 - 15*	*m*	*m*	*m*	*m*	*m*	*m*
OECD average	**4 - 16**	*1572*	*2516*	*2759*		*1558*	*2521*	*2817*	*14*	*-5*	*-59*

Notes on 2001 data:

1. Czech Republic and Israel: data for 2004;

2. Poland and Luxembourg: data for 2003;

3. Netherlands: ages 7-8 data are for 2003 (ages 9-11 and 12-14 data for 2001 and 2003 are identical).

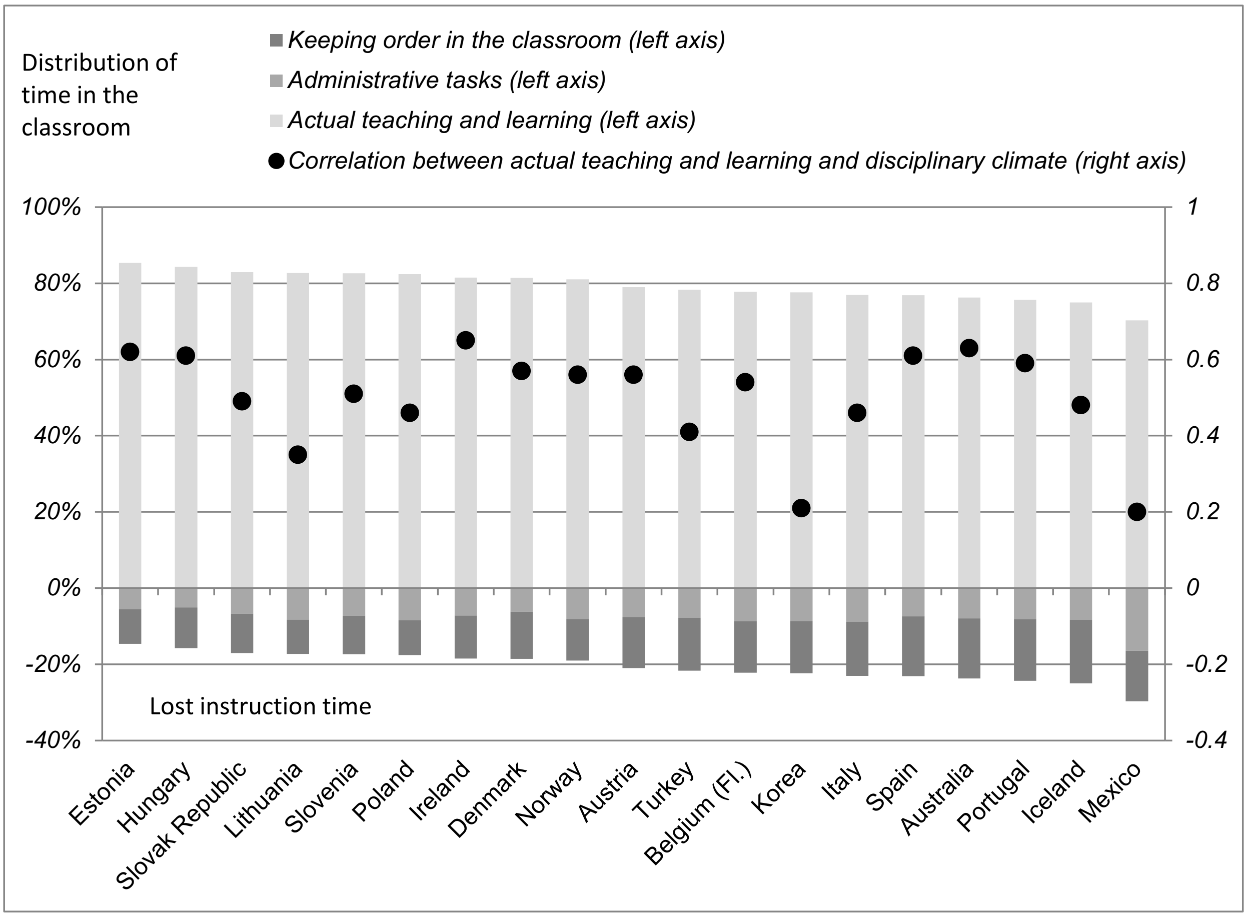
Table A3.2 Frameworks for teacher pay for additional teaching time and extracurricular activities

	Criteria for deciding on payments for teachers in public institutions and level at which they are set (2012)						Requirements for teachers to work on extra-curricular activities (2012)	Average hours teachers report spending per week on extracurricular activities (TALIS 2013)	Percentage of students in schools offering additional mathematics lesson beyond regular instruction (PISA 2012)
	Teaching more classes or hours than required by full-time contract			Special activities (e.g. sports and drama clubs, homework clubs, summer school, etc.)					
	Base salary scale position	Supplemental payments		Base salary scale position	Supplemental payments				
		Annual	Incidental		Annual	Incidental			
Australia	a	a	a	a	a	a	School	2.3	64.1
Austria	a	School	a	a	a	School	m	a	47.8
Belgium (Fl.)	a	a	Central	a	a	a	School	1.3	61.0
Belgium (Fr.)	a	a	a	a	a	a	No	a	61.0
Canada	a	a	a	a	a	a	m	a	66.0
Chile	a	a	a	a	a	a	Central	2	72.7
Czech Republic	a	School	School	a	School	School	School	1.3	51.4
Denmark	a	School	School	a	School	School	Central	0.9	38.9
England	a	a	a	a	a	a	School	2.2	a
Estonia	a	School	School	a	School	School	Central	1.9	70.8
Finland	a	School/Loc or reg	School/Loc or reg	a	School/Loc or reg	School/Loc or reg	No	0.6	59.3
France	a	School	School	a	School	a	No	1	64.7
Germany	a	a	Loc or reg	a	a	a	No	a	63.3
Greece	a	a	School	a	a	a	School	a	28.2
Hungary	a	a	Loc or reg	a	a	a	School	a	84.9
Iceland	a	Loc or reg	School	a	Loc or reg	School	No	1.1	50.5
Ireland	a	a	a	a	a	a	m	a	53.9
Israel	a	School	a	Central	School	a	Central	1.7	84.4
Italy	a	a	School	a	a	School	No	0.8	89.0
Japan	a	Loc or reg	a	a	a	Loc or reg	a	7.7	74.2
Korea	a	a	Central	a	a	a	School	2.7	91.8
Luxembourg	a	a	Central	a	a	a	No	a	95.7
Mexico	Central	Central	a	a	a	a	a	2.3	61.4
Netherlands	School	School	School	School	School	School	School	1.3	56.2
New Zealand	a	a	a	a	School	a	School	a	87.4
Norway	a	a	School/Loc or reg	a	School/Loc or reg	School	No	0.8	30.7
Poland	a	Central	a	a	a	a	Central	2.4	87.3
Portugal	a	a	School	a	a	a	Central	2.4	89.5
Scotland	a	a	a	a	a	a	No	a	a
Slovak Republic	a	School/Loc or reg	School	a	School	School	a	2	65.2
Slovenia	a	a	School	a	a	School	School	a	79.2
Spain	a	a	a	a	a	a	Central	0.9	40.0
Sweden	a	a	School	a	a	a	No	0.4	66.8
Switzerland	a	a	Loc or reg	a	a	Loc or reg	m	a	56.8
Turkey	a	Central	a	a	Central	a	Central	a	46.9
United States	a	a	a	a	Loc or reg	a	School	3.6	63.6

Note: "Loc or reg" refers to the local or regional levels.

Source: OECD (2014b), Education at a Glance 2014: OECD Indicators, http://dx.doi.org/10.1787/eag-2014-en, Tables D3.7a, b and c and Table D4.4c; OECD (2014a), TALIS 2013 Results: An International Perspective on Teaching and Learning, http://dx.doi.org/10.1787/9789264196261-en, Table 6.12; OECD (2013b), PISA 2012 Results: What Makes Schools Successful (Volume IV): Resources, Policies and Practices, http://dx.doi.org/10.1787/9789264201156-en, Table IV.3.29.

Figure A4.1 Teacher reports on lost instruction time and disciplinary climate (2007/08)



Note: Distribution of time spent in the classroom during an average lesson, as reported by teachers in OECD's Teaching and Learning International Survey 2008.

Source: OECD (2009), Education at a Glance 2009: OECD Indicators, http://dx.doi.org/10.1787/eag-2009-en, Table D6.1 and Chart D6.1.

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