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# Compulsory Preschool in Latin America: Comparative Evolution and Future Challenges

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## Abstract

The establishment of Early Childhood Education (ECE) as a key to the success of different aims on the global agendas—Education for All Framework (EFA), Sustainable Development Goals (SDGs), among others—has contributed to the extension of ECE programs and preschool around the world. Latin American countries have also advocated for the development agendas, with the essential role played by education for sustainable human development. Over the last decades, these countries have made dramatic efforts to increase preschool coverage, with a broad success that favors the level of attainment in primary education. Even when this expansion has been broadly recognized as a significant progress for the improvement of ECE access for many young children in the region, it has been acknowledged that the extent of this expansion has been very unequal. The comparative study helps to reveal the different developments, as well as the diverse situations and political agendas for ECE, when Latin American countries adopt international agendas to their particular realities and education contexts. In this view, this study aims to identify the broad trends trying to include the affluent frames and evolutions of compulsory preschool in Latin America in order to open a space for debate around the particular pathways that this ECE policy has implicated in this region.

**Keywords:** preschool education, Latin America, comparative research, compulsory education, evolution

## 1. Introduction

Over the last decades, the establishment of the Early Childhood Education (ECE) as a key to the success of different aims on the international agendas for education, which is based on the recognition that ECE services can contribute to these goals, has been one of the main issues of the global agenda. As a matter of fact, early childhood education has become one of the areas identified for improvement within this framework, as the UNESCO-sponsored World Conference on Early Childhood Care and Education: Building the Wealth of Nations in Moscow, September 2010 outlined in its purpose. Hence, the Moscow Framework for Action and Cooperation, adopted by the Conference [1], moved ECE higher up on political agendas by planning a strategic position for ECE in the now current development and education agendas.

Nowadays, the SDGs hold the quality of early childhood care and education systems as a key element of the goal number 4 on education, and it is understood to play a major role in achieving the desirable outcomes [2]. In this respect, education SDG 4 covers learning from early childhood through adulthood, while stressing the universality of the goals and targets for countries at every level of development, as well as the key themes of education quality, learning, inclusion, and equity. Equity is emphasized here as means of focusing on quality without addressing the many aspects related to those on the margins and those who have been left behind. Actually, the beneficial role of quality ECE to, among other contributions, guarantee the success of the attainment and completion of primary education has been fully demonstrated by diverse international surveys, such as Program for International Student Assessment (PISA). This named survey across OECD countries shows that there is a better performance for students at the age of 15 years who attended preprimary school than for those who did not attended, even after accounting for students' socioeconomic status [3].

Latin American countries have also advocated for the development agendas, with the essential role played by education for sustainable human development. Moreover, when referring to education challenges in achieving the education goals in the region, the expansion of early childhood care and education services remained a priority [4]. Along this same line, the Economic Commission for Latin America and the Caribbean (ECLAC) aims at the universalization of preschool education [5], from an approach that is matched by the OECD [6], with respect to the central role of education policies in the fight against the transmission of inequality from one generation to the next. This is an especially relevant goal if those policies have been concerned with early childhood and the advancement of compulsory education. Yet, the inequitable socioeconomic structure of Latin America indeed interacts with the inequality in educational participation also at the ECE level, resulting in a dynamic where preschool education can hardly develop as the desirable equalizer to potentially tackle these social inequalities.

There is a widespread consensus in considering that overcoming the serious inequalities is the greatest structural challenge for the entire region of Latin America [5], especially because these disparities spread in the context of low socioeconomic mobility, which stems from existing political and family mechanisms that perpetuate the problem [7]. As a result of this imbalance, the disadvantaged groups continue to suffer lower opportunities of education, and unequal education continues to be as one of the challenges from the Latin American educational reality. The UNESCO Regional Bureau for Latin America and the Caribbean (OREALC) noticed that important levels of inequality related to elements such as social class, ethnic origin, and geographic location can be found in all countries of the region, which constitute the factors blocking the expansion of the provision of quality education [8]. Furthermore, the educational mobility in Latin America is very limited in comparison with other regions of the planet; thus, when the educational attainment from one generation with respect to their parents is assessed, the correlation between the level of the parents and their children is significantly higher in this region than in the rest of them [9].

Bearing in mind these conditional factors, the aim of this work is to examine and compare the impact of the implementation of compulsory preschool education in the different Latin American countries and their diverse societies. Specifically, the focus is on the extent to which preschool education can mitigate the social inequalities in children's learning outcomes generated within the family context. Therefore, comparable data are analyzed and confronted in order to disentangle if compulsory preschool education can reduce social inequalities in educational attainment within this region.

## 2. Methodology

In World Declaration on Education for All (EFA) 1990, ECE was committed as the first fundamental goal for the Latin American countries that submitted this agenda, and, since then, expanding ECE access has been recognized as a priority. Nevertheless, UNESCO pointed out that the compulsory attendance policy could become a crash course for children prior to enter formal schooling without being complemented by measures to ensure the child's attendance in the early phases of ECE [10]. To this concern, the Educational Goals for 2021, which were adopted by the Ibero-American Conference on Education and reaffirmed in 2010, include ambitious goals relating to ECE. Particularly, the third general goal and its target reflect the political importance that the expansion of ECE from the early ages has taken on in the region. Moreover, the targets to include the children from vulnerable groups in this expansion can be founded in the second target from this agenda in order to promote equity and an equitable access to ECE. Quality ECE for low socioeconomic status children has been found to benefit from ECE to a greater extent than high socioeconomic status children [11]. Hence, it has been necessary to monitor the expansion of access to ECE as a first step to assess the equity but, along with it, the equity of the distribution and the quality of the provision needs to be examined.

The implementation and evaluation of the above-mentioned agendas have provided for strategies and action plans, as well as they have open new prospects to identify the trends and development of their consecution over time. As positive consequence, nowadays, it is possible to measure and compare the levels of achievement that the Latin American countries have reached in the expansion of ECE over the last decades. This comparative exercise allows the establishment of particular paths and dynamics that have taken place in the different countries and moments, in order to relate them with the present challenges and opportunities that education is facing within this diverse reality.

For the purpose of this work, the selection of indicators responds to the availability of comparable data of ECE in Latin American countries, focusing on the mandatory attendance policies and the real benefit of them. Therefore, in the next section, compared information shows a short description of the main types of provision of the national system in early childhood education together with the main selected elements on compulsory preschool education. These elements are the mandatory access and the age range for a guaranteed place, as well as the evolution of school life expectancy in ECE and of the scope of children with preschool experiences after the transition to primary school. Furthermore, in this first subsection, there are also compiled data on the equity of access in order to study the development and achievement of ECE expansion by comparing the enrolment ratios over time, as well as the school life expectancy.

The second subsection of the comparative study will focus on the last three rounds of PISA results and its evolutions from a selection of countries in order to relate their developments with the progresses on the implementation and the expansion of the compulsory attendance policies in ECE. This cross-national study of the comparable data over time can reveal to what extent the compulsory attendance policy has benefitted the Latin American countries, from a general perspective. In the same line, this exercise can help to show the disparities between these countries and the different social groups within these countries.

Bearing in mind that there are multiple pathways and different influences to understand the diverse ways in which ECE policy can be made efficient [12, 13], the comparative conclusions of this study will be presented in the final section of the work. There, some future perspectives and challenges around the compulsory preschool are also discussed, in order to complement the extracted conclusions.



### 3. Cross-national study of the compulsory preschool in the Latin American countries

#### 3.1 Compulsory preschool education in Latin America

Historically, there has been a common trend among the Latin American countries toward the so-called divided model in the provision of ECE. For most of the cases, this division was established in terms of age, as it was also the designation and definition of the great variety of arrangements. However, since the 1990s, the universalization of at least the last year of preschool spreads as a goal throughout Latin America [14] and the implementation of its mandatory character has been determinant to set the current structure of ECE in the region.

Nowadays, in all the Latin American countries, preschool attendance is mandatory at the age of 5 years old, even though in some of the nations, this situation can start earlier for young children. As can be observed in **Table 1**, the laws on compulsory preschool education have been instituted in this region over the past two decades, although some of these countries did earlier (see the **Table 1** additional notes on the cases of Panama and Venezuela in 1946 and 1980, respectively). Nevertheless, the effectiveness of these initiatives has been only noted in recent times along the steady increase of the public investment on this level of each national education system. Thereby, **Table 1** shows significant and positive advances in the level of government expenditure on preprimary education per pupil, expressed as a percentage of the GDP per capita, in the majority of the countries over the decades when compulsory attendance policies were being implemented. As a result, all the Latin American countries have expanded the provision and opportunities of ECE for the age groups immediately preceding entry into the primary education cycle, according to the information drawn from the selected indicators in **Table 1**. This is the case for the number of years of free ECE that is now offered in every Latin American country and which is covered for 3 years in more than the half of these countries, with the only case of Chile where this value is below 2 years of free ECE. Another successful achievement has been the evolution of school life expectancy in preprimary education between 2002 and 2015, as the region on average has achieved a substantial improvement of 0.5 years, and in 13 countries, this indicator has reached the value of 1.5 years or even more (see **Table 1**). This is a fact that, along the rise of ECE enrolment ratios, has been mainly spurred by the widespread strategy in Latin America of mandatory attendance policy over the last decades.

Accordingly, it is visible in **Table 1** that during the period between 2002 and 2015, the Adjusted Net Enrolment Ratio (ANER [15]) 1 year before the official primary school entry age (%) has incremented all over the Latin American region. Furthermore, the nations that present the highest scores over 90% of new entrants with such experience by 2015 (Argentina, Brazil, Chile, Costa Rica, Ecuador, Mexico, Peru, Uruguay, and Venezuela) are mainly corresponding with those with the highest preschool life expectancy (see **Table 1**).

To sum up, from the comparative analysis of the **Table 1**, it can be concluded that all the Latin American countries have expanded the provision and opportunities of learning for young children prior to the primary entry since 2002. Notwithstanding the differences on the expansion of preschool coverage and progress between these countries exhibit a high level of variability, just as the increases in the enrolment ratios between 2000 and 2015 did not have the same intensity along the countries of the region. For instance, countries like Bolivia or Ecuador have experimented the highest increments (over 20 percentage points) in the ANER between 2002 and 2015 to achieve the highest standards (above 90%) compared

| Countries   | Current regulation on compulsory preschool education and age group | Free ECE (years) | Government expenditure on preprimary education per pupil as % of GDP per capita |         | School life expectancy in preprimary education (years) |                  | ANER 1 year before the official primary school entry age (%), school year ending in |                   |
|-------------|--|------------------|---|---------|--|------------------|---|-------------------|
|             |  | 2015             | 2002  | 2015    | 2002   | 2015             | 2002  | 2015              |
| Argentina   | (Ley Nacional de Educación, 2006)4–5 years old                     | 3                | 9.4   | 11.5    | 1.8  | 2.2              | 99.2  | 98.8 <sub>a</sub> |
| Bolivia     | (Ley de Educación, 2010)4–5 years old                              | 2                | 7.6   | 12.1    | 1  | 1.4              | 67.1  | 92.5 <sub>a</sub> |
| Brazil      | (Lei de Diretrizes e Bases da Educação, 1996)4–5 years old         | 3                | 15.2 <sup>iii</sup>   | 26.4    | 1.6 <sup>iii</sup>                                     | 1.8              | 81.3  | 93 <sub>z</sub>   |
| Chile       | (Ley General de Educación, 2009)5 years old                        | 1                | 13.1  | 18.6    | 1.6  | 2.5              |   | 97.5 <sub>a</sub> |
| Colombia    | (Ley General de Educación, 1994)5 years old                        | 3                | 3.5   | 6.6     | 1.3  | 2.5 <sub>z</sub> | 82.1  | 84.2 <sub>a</sub> |
| Costa Rica  | (Código de Educación Ley N., 2000)3–5 years old                    | 3                | 14.8  | 18.3    | 1.2  | 1.6              | 85.1  | 93.4              |
| Ecuador     | (Ley Orgánica de Educación Intercultural, 2011)3–5 years old       | 3                | 34.6*   | 24.8    | 0.7  | 2.1              | 74.7  | 97.5              |
| El Salvador | (Ley General de Educación, 1996)4–6 years old                      | 3                | 6.1   | 6.8     | 1.6  | 2.0              | 75.4  | 85.5              |
| Guatemala   | (Ley Nacional de Educación 1991)4–6 years old                      | 2                | 4.8   | 15.5    | 1.1  | 1.4              | 65.0  | 80.7              |
| Honduras    | (Ley fundamental de educación, 2011)5 years old                    | 3                | ..  | 14.1    | 1 <sup>i</sup>   | 1.2              | ..  | 81.3 <sub>a</sub> |
| Mexico      | (Ley General de Educación, 1993)3–5 years old                      | 3                | 13.9  | 13.1*** | 1.4  | 2.1              | 83.4  | 98.7              |
| Nicaragua   | (Ley General de Educación, 2006)5 years old                        | ..               | 0.6 <sup>ii</sup>   | 4.2**   | 1.3  | 1.8**            | 73.3  | 87.3***           |
| Panama      | (Ley Orgánica de Educación, 1995)4–5 years old                     | 2                | 3.9   | 3.9***  | 1.1  | 1.5              | 72.2  | 79.3              |
| Paraguay    | (Ley General de Educación, 1998)5 years old                        | 3                | 12.1  | 12.8    | 1  | 1.1***           | ..  | 77.9***           |
| Peru        | (Ley General de Educación, 2003)3–5 years old                      | 3                | 6.4   | 13.2    | 1.8  | 2.7              | 85.4  | 98.8              |
| Uruguay     | (Ley General de Educación, 2008)4–5 years old                      | 2                | 8.0   | ..      | 2  | 2.7              | 100 <sup>ii</sup>   | 96.7              |

| Countries   | Current regulation on compulsory preschool education and age group | Free ECE (years) | Government expenditure on preprimary education per pupil as % of GDP per capita |        | School life expectancy in preprimary education (years) |      | ANER 1 year before the official primary school entry age (%), school year ending in |      |
|---|--|------------------|---|--------|--|------|---|------|
|   |  | 2015             | 2002  | 2015   | 2002   | 2015 | 2002  | 2015 |
| Venezuela   | (Ley Orgánica de Educación, 2009)3–5 years old                     | 3                | 7.22 <sup>iii</sup>   | 17.12* | 1.5  | 2.3  | 76.1  | 92.3 |
| <i>Explanatory notes: ANER 1 year before the official primary school entry age is the percentage of children at the intended age a year before entry into primary education who are enrolled in either preprimary or primary education.</i> |  |                  |   |        |  |      |   |      |
| <i>a: 2016 by UNESCO.UIS; <sup>i</sup>2003; *2008;</i>  |  |                  |   |        |  |      |   |      |
| <i>z: National estimate; <sup>ii</sup>2005; **2010;</i>   |  |                  |   |        |  |      |   |      |
| <i>.. No registered; <sup>iii</sup>2006; ***2012.</i>   |  |                  |   |        |  |      |   |      |
| <i>Source: Table by author. Data extracted from UNESCO.UIS (2018), SIPI (2017), and ECLAC (2016).</i>   |  |                  |   |        |  |      |   |      |

**Table 1.**  
*Mandatory Early Childhood Education in Latin America: provision, regulations, compulsory age, school life expectancy.*

with the rising in Brazil, Costa Rica, Mexico, or Venezuela (between 8.6 and 16.2 percentage points) or another countries such as Argentina or Uruguay that just had to keep these standards during this time (see **Table 1**).

Whatsoever, the implementation of compulsory preschool by the introduction of national laws in the Latin American countries can be considered as a constructive measure in the understanding and recognition of education as a fundamental human right. The evidence from **Table 1** indicates that the application of a year of free compulsory ECE derived in a general trend to extend preschool for all the young children in Latin America, yet the effectiveness of these measures has been constrained by every idiosyncrasy. Thus, despite the great improvements of the region, in countries such as Panama or Paraguay, the age group of children immediately preceding entry into the primary education cycle is still not benefiting from this legislative initiative by a wide margin (over the 80% ANER 1 year before the official primary school entry age). Moreover, the group of countries that now has to keep the efforts to overcome the value of 90% of ANER 1 year before the official primary school entry age, toward the current target of the Educational Goals for 2021, represents almost a half of the region. This is visible on **Table 1**, where this group includes the two above-mentioned countries and five more (Colombia, El Salvador, Guatemala, Honduras, El Salvador, and Nicaragua), even the availability and reliability of data remain a challenge of this measurement [16].

In order to chart the achievements of such mandatory policy and its benefits for young children, comparable data need to be interpreted in detail and to be disaggregated. Equally, causational studies to analyze the effect of preschool attendance on children’s academic skills in Latin America were provided with caution, as no direct reference to a causal effect can be made [17]. The existence of still sharp differences in ECE access continues to be linked to the socioeconomic status and area of residence in the region, at the same time that the role of quality ECE has been pointed out as an equalizer [3]. The main question to be formulated at this point is whether the benefits of these mandatory ECE measures can have significant impacts in a very despair reality such as the Latin American region rather than to question the extent of its universalization.

Therefore, in the next subsection, the focus will be on the comparable and complementary data available that help to address if preschool education can mitigate the social inequalities in the children’s learning outcomes of this region.



3.2 Effects of compulsory preschool education in Latin America

The comparative study of the Latin American region involves great challenges when trying to approach the development and results of educational policies. There are some conditioning factors of this particular context such as the socioeconomic inequality or the diversity of the different social, cultural, and political frameworks that characterize the region [5]. Along to this fact, the idiosyncrasy of each Latin American country reveals the diverse traditions and situations of ECE in the region, which help to explain the different frames and evolutions that give the priority and adopt the challenges from the international and regional agendas of education. Hence, in the following pages, far from standardizing inferences, the aim is to draw the paths that some of the Latin American countries have followed in the run to implement such agendas and their goals concerning preschool education. Thereby, in the first place, the impact of the ECE mandatory attendance policy is studied in detail through the evolutions of ANER 1 year before the official primary age considering the date of its implementation. In the second place, some of these national evolutions through the years are confronted with the level of later academic performance for those same age groups.

As it was evidenced in the previous subsection, significant differences can be founded among the Latin American countries when the developments of the percentages of the net enrolment rate 1 year before the official primary entry age are compared during the last years. However, it is important to study these evolutions in detail to bring to light the value of the historical traditions and the levels of effectiveness once the mandatory attendance policy came into play in the different countries. To this respect, bearing in mind the information from **Table 1** and **Figure 1** concerning the national dates of implementation of this measure, it is worth to attend to the different evolutions from these countries that can be confirmed in **Table 2**. This is the case for countries such as Colombia, Costa Rica, El Salvador, Guatemala, Panama, or Peru, where the implementation of mandatory preschool attendance during 1990 and 2000 resulted into later significant rises in the ANER 1 year prior primary.

|   |
|---|
| Argentina: The Ley de Educación Nacional (2006), N. 26.206, modified by the Ley N. 27.045 in 2014.  |
| Brazil: The Lei de Diretrizes e Bases da Educação (1996), N. 9.394/96, modified in 2006 and 2009.   |
| Colombia: The Ley General de Educación (1994) established compulsory preschool education for the age of 5 years old.  |
| El Salvador: The Ley General de Educación Decreto N. 917 (1996), revised in 2000, 2003 and 2005.  |
| Guatemala: The Ley de Educación Nacional N. 12-91 (1991), revised in 2006, established compulsory preschool education for the age of 5 years old.                                     |
| Mexico: The Ley General de Educación (1993), revised in 2000, 2003, 2004, 2005, 2006, 2013 and 2014; established compulsory preschool education for the age of 5 years old in 2004.   |
| Panama: The Ley Orgánica de Educación N. (1946), revised in 1995 by the Ley N. 34, established compulsory preschool education between 4-5 years old.                                  |
| Paraguay: The Ley Nº 4088 (2010) established ECE free-of-charge, but since the Ley General de Educación (1998) established compulsory preschool education for the age of 5 years old. |
| Venezuela: The Ley Orgánica de Educación from 1980, revised in 1999, established compulsory preschool education for the age of 5 years old.   |

**Figure 1.**  
*Additional notes on countries' implementation of mandatory ECE. Source: By author. Data extracted from ECLAC (2016).*



| COUNTRIES   | ADJUSTED NET ENROLMENT RATE ONE YEAR BEFORE THE OFFICIAL<br>PRIMARY ENTRY AGE (%), 1999, 2002 and 2005 |      |        |       |      |        |       |      |        |
|-------------|--|------|--------|-------|------|--------|-------|------|--------|
|             | 1999   |      |        | 2002  |      |        | 2005  |      |        |
|             | Total  | Male | Female | Total | Male | Female | Total | Male | Female |
| Argentina   | 97.3   | 96.1 | 98.5   | 99.3  | 98.6 | 100    | 99.3  | 98.6 | 100    |
| Bolivia     | 62.3   | 62.4 | 62.3   | 67.1  | 66.5 | 67.7   | 72.7  | 72.7 | 72.7   |
| Brazil      | 82.1   | ..   | ..     | 81.2  | ..   | ..     | 88.1  | 87.8 | 88.4   |
| Chile       | 82.1*  | ..   | ..     | 79.3* | ..   | ..     | 79.8* | ..   | ..     |
| Colombia    | 74.3   | ..   | ..     | 82.1  | ..   | ..     | 93.0  | 92.4 | 93.7   |
| Costa Rica  | 46.7*  | ..   | ..     | 61.5* | ..   | ..     | 71.5* | ...  | ...    |
| Ecuador     | 66.2   | 64.7 | 67.8   | 74.7  | 73.4 | 76.1   | 78.7  | 77.9 | 79.5   |
| El Salvador | 55.1   | 50.3 | 60.7   | 75.5  | 73.3 | 77.7   | 81.3  | 80.4 | 82.3   |
| Guatemala   | 55.7   | 53.7 | 51.6   | 65.0  | 63.7 | 64.7   | 72.9  | 73.2 | 73.3   |
| Honduras    | 16.3*  | ..   | ..     | ..    | ..   | ..     | 31.1* | ..   | ..     |
| Mexico      | 84.8   | 84.4 | 85.3   | 83.4  | 84.9 | 83.5   | 92.1  | 87.3 | 92.1   |
| Nicaragua   | 29.7*  | ..   | ..     | 33.6* | ..   | ..     | 73.3  | 71.4 | 75.4   |
| Panama      | 57.1   | 57.0 | 57.2   | 76.9  | 77.2 | 77.2   | 78.5  | 78.3 | 78.8   |
| Paraguay    | 29.6*  | ..   | ..     | 32.9* | ..   | ..     | 35.1* | ..   | ..     |
| Peru        | 76.5   | 75.4 | 77.2   | 84.6  | 82.8 | 85.4   | 88.9  | 88.2 | 89.6   |
| Uruguay     | 59.5*  | ..   | ..     | 66.6* | ..   | ..     | 99.6  | 99.2 | 100    |
| Venezuela   | 69.4   | 68.6 | 70.3   | 75.5  | 74.9 | 77     | 77.1  | 76.6 | 77.6   |

Explanatory notes: \*Gross enrolment ratio.  
Source: Table by author. Data extracted from UNESCO UIS (2018).

**Table 2.**  
*Latin America adjusted net enrolment rate 1 year before the official primary entry age preschool education (%) school year ending in 1999, 2002, and 2005.*

Despite that the ECE compulsory attendance policy was often announced as a sign of the government’s commitment to ECE [18], its necessity has been in question as it did not seem always to help increase global enrolments in preprimary education [10]. In fact, for some of these Latin American countries, where enrolments were much higher during this period of time, such policy was yet nonexistent (see **Tables 1** and **2**). From this comparative analysis, thus, it can be concluded that the institutionalization of compulsory preschool in the Latin American region had positive effects toward the democratization of ECE and learning opportunities for the age group of children immediately preceding entry into the primary education cycle over the last decades. Yet, the effect of universalization is not a reality in half of the countries of this region (see **Table 1**).

In an attempt to relate these developments on the progresses through the implementation and the expansion of the compulsory attendance policies in ECE with the later educational attainment, PISA results are being compared among several representative countries from Latin America who had undertaken this test over the last three periods. For this purpose, the selected periods of time from **Table 2** (1999, 2002, and 2005) were the years that the same students who participated in the rounds of an international examination attended preschool by the age of 5 years. The PISA examination consists of tests in mathematics, reading, and science that have been taken every 3 years by 15-year-old students who are in grade seven or above and allow for cross-country comparisons and rankings. The PISA Reading, Mathematics, and Science scale range from 0 to 1000, and they can be presented by disaggregating the preschool variables of “Attend ISCED 0” and “Age when started ISCED 0”. Supply information about the personal and family situations of the students is also compiled when the test is filled out by students. These data have been used to construct the preschool variable, which signals whether the student: (i) never attended preschool; (ii) attended preschool for 1 year or less; or (iii) attended preschool for more than 1 year.

The comparable character of the PISA results helps to reveal the existing disparities among the Latin American countries that have been assessed under this program. Equally, the comparative study can help to find evidence of the impact that the preschool attendance had in such results or its evolutions within this region, in order to discuss if the mandatory attendance policies have played a decisive function in them or not. Only eight Latin American countries have been undertaking this international examination over the last rounds of evaluation in 2009, 2012, and 2015. Hence, no generalizations can be extended from their results to the entire region. Nevertheless, the fact that those countries of the Latin American region hold the highest rates in preprimary school life expectancy, as well as in the ANER 1 year before the official primary age (see **Table 1**), makes them a good representation of the cases where the mandatory preschool policy has not failed. A previous comparison of the PISA test scores in Latin America from 2009 and 2012 using the Preschool variable with no controls revealed a positive correlation between early education—and its duration—and academic performance at the secondary education level in all the countries [17]. In PISA 2015, a subsample of students who took the core PISA assessment for mathematics, science, and reading literacy were administered the financial literacy and the collaborative problem solving components. This was different than PISA 2012, where the sample of students who took the financial literacy assessment was separate from the sample who took the core assessment. Hence, mathematics and reading scores obtained from the PISA 2012 financial literacy database were calibrated and standardized separately and thus may not match mathematics and reading scores obtained from the combined mathematics, reading, and science database. Supply data to construct the preschool variable is also different in PISA 2015, which signals whether the student: (i) never attended preschool; (ii) attended preschool for 1 year or less; (iii) attended preschool for more than 1 year, disaggregating the last two categories by the age when the student started to attend ISCED 0. Still mathematics, reading, and science scores obtained from the PISA 2015 financial literacy or collaborative problem solving database are comparable across databases. Therefore, in order to make comparable the scores by the preschool variable over the last rounds of PISA, estimations were made to obtain the values “attended preschool for one year or less” and “attended preschool for more than one year” (see explanatory notes from **Tables 3, 4** and **5**).

Generally speaking, when the score in mathematics of students who had access to more than 1 year of preschool is compared with those who did not have access to preschool education, there is a significant advantage for the former group in all these countries for the last three rounds of PISA (2009, 2012, and 2015). Even no causal effect can be estimated due to the lack of randomly assignment of treatment and control groups to ensure bias-free estimations [17], in all the countries of the Latin American region participating in PISA 2012 and 2009, students have performed better in mathematics if they had more than 1 year of preschool education. This is a trend that most of these countries presented in PISA 2009 (data for Costa Rica are not available) and that can also be confirmed for the participant Latin American countries in PISA 2015 (see **Table 3**). Yet these considerable score differentials in **Table 3** tend to become less remarkable over time, with the exemptions of Chile (between 2009 and 2012 PISA scores) and Costa Rica (between 2012 and 2015 scores). In the case of students that had 1 year or less of preschool, the score differentials in mathematics compared with the students that did not attend preschool are less significant, and the progresses through time show that the advantage of this group of students over the students that did not attend preschool can be even questioned in countries like Brazil, Colombia, and Uruguay (see **Table 3**). However, no causal effect with the implementation of mandatory preschool policy can be established from this analysis, and only observations like the case of Peru where the overall scores in mathematics have improved through these periods of time.



|     | PISA<br>2009<br>Total | PISA<br>2009<br>≤ 1<br>year | PISA<br>2009<br>> 1<br>year | PISA<br>2009<br>Did<br>not<br>attend | PISA<br>2012<br>Total | PISA<br>2012<br>≤ 1<br>year | PISA<br>2012<br>> 1<br>year | PISA<br>2012<br>Did<br>not<br>attend | PISA<br>2015<br>Total | PISA<br>2015<br>≤ 1<br>year | PISA<br>2015<br>> 1<br>year | PISA<br>2015<br>Did<br>not<br>attend |
|-----|-----------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------------|
| ARG | 388                   | 370                         | 403                         | 335                                  | 388                   | 366                         | 403                         | 337                                  | 409                   | 395                         | 415                         | 368                                  |
| BRA | 386                   | 386                         | 408                         | 358                                  | 389                   | 383                         | 405                         | 366                                  | 377                   | 363                         | 391                         | 368                                  |
| CHL | 421                   | 420                         | 441                         | 393                                  | 423                   | 423                         | 436                         | 381                                  | 423                   | 409                         | 405                         | 393                                  |
| COL | 381                   | 386                         | 397                         | 349                                  | 376                   | 380                         | 385                         | 351                                  | 390                   | 372                         | 400                         | 383                                  |
| CRI | -                     | -                           | -                           | -                                    | 407                   | 408                         | 416                         | 384                                  | 400                   | 393                         | 425                         | 392                                  |
| MEX | 419                   | 416                         | 426                         | 375                                  | 413                   | 411                         | 419                         | 378                                  | 408                   | 392                         | 416                         | 383                                  |
| PER | 365                   | 364                         | 384                         | 336                                  | 368                   | 360                         | 384                         | 328                                  | 387                   | 350                         | 399                         | 354                                  |
| URY | 427                   | 411                         | 443                         | 373                                  | 409                   | 390                         | 426                         | 370                                  | 418                   | 367                         | 437                         | 422                                  |

**Explanatory notes:**

– Not available.

Total: Averages for PISA mathematics scale: overall mathematics, age 15 years by Age when started [ISCED o].

≤ 1 year: refers to the attendance to ECE for one year or less. Values for the 2015 results have been estimated from the average results of the values decomposed by ages “5 years” and “6 years or more” with the exemption of Argentina (see Appendix 1).

> 1 year: refers to the attendance to ECE for more than one year. Values for the 2015 results have been estimated from the average results of the values decomposed by ages “1 year or younger”, “2 years”, “3 years” and “4 years” with the exemption of Argentina (see Appendix 1).

Source: Table by author. Data extracted from Organization for Economic Cooperation and Development (OECD), PISA, 2009, 2012, and 2015 Reading, Mathematics and Science Assessments

**Table 3.**

Average PISA test scores in Mathematics, total and by category of preschool variable, 2009, 2012, and 2015.

In the case of the average scores in reading in **Table 4**, when the pattern of students who had access to more than 1 year of preschool is compared with those who did not have access to preschool education, there is, again, a significant

|     | PISA<br>2009<br>Total | PISA<br>2009<br>≤ 1<br>year | PISA<br>2009<br>> 1<br>year | PISA<br>2009<br>Did<br>not<br>attend | PISA<br>2012<br>Total | PISA<br>2012<br>≤ 1<br>year | PISA<br>2012<br>> 1<br>year | PISA<br>2012<br>Did<br>not<br>attend | PISA<br>2015<br>Total | PISA<br>2015<br>≤ 1<br>year | PISA<br>2015<br>> 1<br>year | PISA<br>2015<br>Did<br>not<br>attend |
|-----|-----------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------------|
| ARG | 398                   | 379                         | 416                         | 331                                  | 396                   | 373                         | 412                         | 337                                  | 425                   | 405                         | 435                         | 370                                  |
| BRA | 412                   | 414                         | 439                         | 379                                  | 407                   | 401                         | 426                         | 379                                  | 407                   | 392                         | 422                         | 397                                  |
| CHL | 449                   | 452                         | 465                         | 419                                  | 441                   | 443                         | 453                         | 401                                  | 459                   | 449                         | 432                         | 421                                  |
| COL | 413                   | 419                         | 429                         | 380                                  | 403                   | 407                         | 414                         | 374                                  | 425                   | 406                         | 434                         | 419                                  |
| CRI | -                     | -                           | -                           | -                                    | 441                   | 420                         | 449                         | 422                                  | 427                   | 419                         | 458                         | 421                                  |
| MEX | 425                   | 424                         | 434                         | 378                                  | 424                   | 422                         | 430                         | 383                                  | 423                   | 406                         | 430                         | 389                                  |
| PER | 370                   | 368                         | 392                         | 337                                  | 384                   | 374                         | 402                         | 342                                  | 398                   | 356                         | 414                         | 349                                  |
| URY | 426                   | 405                         | 445                         | 368                                  | 411                   | 396                         | 436                         | 368                                  | 437                   | 380                         | 458                         | 404                                  |

**Explanatory notes:**

– Not available.

Total: Averages for PISA reading scale: overall reading, age 15 years by Age when started [ISCED o].

≤ 1 year: refers to the attendance to ECE for one year or less. Values for the 2015 results have been estimated from the average results of the values decomposed by ages “5 years” and “6 years or more” with the exemption of Argentina (see Appendix 2).

> 1 year: refers to the attendance to ECE for more than one year. Values for the 2015 results have been estimated from the average results of the values decomposed by ages “1 year or younger”, “2 years”, “3 years” and “4 years” with the exemption of Argentina (see Appendix 2).

Source: Table by author. Data extracted from Organization for Economic Cooperation and Development (OECD), PISA, 2000, 2003, 2006, 2009, 2012, and 2015 Reading, Mathematics and Science Assessments.

**Table 4.**

Average PISA test scores in Reading, total and by category of preschool variable, 2009, 2012, and 2015.

|     | PISA<br>2009<br>Total | PISA<br>2009<br>≤ 1<br>year | PISA<br>2009<br>> 1<br>year | PISA<br>2009<br>Did<br>not<br>attend | PISA<br>2012<br>Total | PISA<br>2012<br>≤ 1<br>year | PISA<br>2012<br>> 1<br>year | PISA<br>2012<br>Did<br>not<br>attend | PISA<br>2015<br>Total | PISA<br>2015<br>≤ 1<br>year | PISA<br>2015<br>> 1<br>year | PISA<br>2015<br>Did<br>not<br>attend |
|-----|-----------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------------|-----------------------|-----------------------------|-----------------------------|--------------------------------------|
| ARG | 398                   | 384                         | 416                         | 345                                  | 396                   | 384                         | 420                         | 354                                  | 432                   | 417                         | 439                         | 390                                  |
| BRA | 405                   | 409                         | 428                         | 377                                  | 402                   | 398                         | 418                         | 377                                  | 401                   | 386                         | 414                         | 400                                  |
| CHL | 447                   | 448                         | 463                         | 422                                  | 445                   | 446                         | 455                         | 409                                  | 447                   | 437                         | 427                         | 411                                  |
| COL | 402                   | 407                         | 414                         | 374                                  | 399                   | 402                         | 406                         | 372                                  | 416                   | 399                         | 425                         | 408                                  |
| CRI | -                     | -                           | -                           | -                                    | 429                   | 429                         | 438                         | 412                                  | 420                   | 412                         | 447                         | 415                                  |
| MEX | 416                   | 415                         | 424                         | 376                                  | 415                   | 414                         | 420                         | 380                                  | 416                   | 399                         | 424                         | 401                                  |
| PER | 369                   | 371                         | 387                         | 340                                  | 373                   | 367                         | 386                         | 341                                  | 397                   | 369                         | 409                         | 361                                  |
| URY | 427                   | 413                         | 442                         | 380                                  | 416                   | 398                         | 432                         | 379                                  | 435                   | 385                         | 454                         | 421                                  |

**Explanatory notes:**

— Not available.

Total: Averages for PISA science scale: overall science, age 15 years by Age when started [ISCED o].

≤ 1 year: refers to the attendance to ECE for one year or less. Values for the 2015 results have been estimated from the average results of the values decomposed by ages “5 years” and “6 years or more” with the exemption of Argentina (See Appendix 3).

> 1 year: referes to the attendance to ECE for more than one year. Values for the 2015 results have been estimated from the average results of the values decomposed by ages “1 year or younger”, “2 years”, “3 years” and “4 years” with the exemption of Argentina (see Appendix 3).

Source: Table by author. Data extracted from Organization for Economic Cooperation and Development (OECD), PISA, 2009, 2012, and 2015 Reading, Mathematics and Science Assessments.

**Table 5.**  
Average PISA test scores in Science, total and by category of preschool variable, 2009, 2012, and 2015.

performance, as in the rest of the Latin American countries, this correlation is negative (see 2015 values, **Table 5**). The average scores in science of students who had access to more than 1 year of preschool, compared with those who did not have access, shows also a considerable advantage for the former group in the majority of the Latin American countries for the last three rounds of PISA (2009, 2012, and 2015); with the greatest margins in Argentina, Uruguay, and Peru as it happened in the mathematics and reading tests (see **Tables 3–5**). The PISA 2015 survey focused on science, with reading, mathematics, and collaborative problem solving as minor areas of assessment. PISA 2015 also included an assessment of young people’s financial literacy, which was optional for countries and economies. Still mathematics, reading, and science scores obtained from the PISA 2015 financial literacy or collaborative problem solving database are comparable across databases. PISA cannot identify cause-and-effect relationships between policies/practices and student outcomes, but the trends that were identified through this comparative analysis help to open up the debates around the effects of mandatory preschool and its duration in the later academic performance. Even more, for the first time, PISA 2015 shows that the changes in science scores per year attending preprimary school are not revealing a positive correlation in all the Latin American countries that have undergone this international examination, especially after accounting for schools’ and students’ socioeconomic profile [19].

From the comparative study of the developments on the ANER 1 year before the official primary age in the Latin American countries that have been undertaking the PISA examinations during the last three rounds, there are some facts that can be related. Therefore, three aspects are considered now to draw these connections: the progresses on the ANER 1 year before the official primary entry age for the established periods when the students of the last three rounds of PISA attended to preschool (1999, 2002, and 2005, respectively); the PISA scores for the group of students that attended to preschool for 1 year or less in the eight Latin American



countries during the established periods (2009, 2012 and 2015); plus the level of universalization of preschool, which means an ANER around the value 100% and never under the 90%. In the last place, some considerations from the last 2015 PISA results will be interpreted with respect to the science performance by the number of years at preprimary school, and they will be taken in account in order to open the discussion around the focus of this work. Hence, the country developments can be summarized in the following highlights:

- Argentina sets off from high levels of ANER over the 90%, reaching almost the universalization of preschool since 2002 (above the 99%), despite no mandatory attendance policy was established until 2006, and it shows positive progresses in all the PISA scores of the last rounds (see **Tables 3–5**).
- Brazil, Colombia, Costa Rica, Peru, and Mexico developed significant rises toward the preschool universalization between 1999 and 2005, as a result of the implementation of the compulsory attendance measures prior and during these years. Nevertheless, these policies did neither make preschool universalization effective over these periods of time nor in the later years, though Mexico and Peru have almost reached it (see **Tables 1** and **2**). Along this fact, the PISA results in these five countries have tended toward worsening over time in all the different tests, as well as the score differentials between the students who did not attend to preschool and those who attended to preschool for 1 year or less (see **Tables 3–5**). Moreover, in PISA 2015, the current values in the changes in science scores per year attending preprimary school are revealing a negative correlation in these five cases after accounting for schools' and students' socioeconomic profile [19].
- Chile is the country that has implemented later a compulsory preschool attendance policy (see **Table 1**). This is also the only Latin American country where data on the ANER 1 year before the official primary entry age have not been available until the recent years; thus, no link can be established for the selected periods of time in this study. However, Chile shows a different trend in the evolution of PISA scores over the last three round of tests, as the score differentials between the students who did not attend to preschool and those who attended to preschool for 1 year or less became greater between 2009 and 2012 but they have diminished significantly between 2012 and 2015 (see **Tables 3–5**). A remarkable feature from this country is that in the last PISA 2015, the differentials in preschool attendance between the top and bottom quarter by the school socioeconomic profile are among the lowest in the Latin American region [20].
- Uruguay shows the greatest advances toward the universalization of preschool, as the rise on the levels of ANER between 1999 and 2005 was over 40 percentage points, reaching the universalization of preschool (above the 99%, see **Table 2**). In parallel, the effects of preschool attendance on the later academic performance have remained over time, as the change in science scores per year attending preprimary school in this country is revealing a very positive correlation, even after accounting for schools' and students' socioeconomic profile [19]. As a matter of fact, the case of Uruguay is quite revealing concerning PISA 2015, as it is the country where the change in science score per year attending preprimary school is the greatest from this region and among the highest of OECD [19].

In sum, from a general perspective, it can be stated that in the Latin American countries where the universalization of preschool has been achieved, PISA results have improved over the years, and the gross gaps have remained wider when the period of preschool attendance is longer than 1 year. This can be explained due both to the direct effect of having been in preschool for a longer period and to the impact of the socioeconomic factors that influence both the duration of attendance in early education and performance on the PISA tests [21]. Furthermore, in the last PISA 2015, the differentials in preschool attendance between the top and bottom quarter by the school socioeconomic profile in the Latin American region [20] show the highest values for the Latin American countries, where free ECE is guaranteed for a longer period (see **Table 1**). In the countries where preschool universalization is still not effective, PISA 2015 is revealing a negative correlation in the current changes in science scores per year attending preprimary [19].

#### 4. Conclusions

ECE policies, such as the institution of compulsory attendance, need to be carefully evaluated with respect to their likely costs and benefits in practice, based on the best available data prior to their adoption [22]. However, this comparative study allows to examine and to compare the impact of the implementation of compulsory preschool education in Latin America to value the different conclusions that can be extracted from its results.

In the first place, the institution of the mandatory attendance policy in preschool education in the Latin American countries over the last years has been supported by a rise of the government expenditure in the ECE. These advances have been translated into significant benefits to expand the preschool provision and to extend the learning opportunities of young children in the region. Hence, it can be concluded from this study how the effects of such measures have been positive in terms of increasing the preschool life expectancy as well as expanding the adjusted net enrolment ratios 1 year before the official primary school entry age in all the Latin American countries over the last 15 years. Yet, almost half of these countries have to keep the efforts toward the current target of the Educational Goals for 2021, thus to overcome the value of 90% of ANER 1 year before the official primary school entry age. Thereby, the implementation of compulsory preschool in Latin American had positive effects toward the democratization of ECE and learning opportunities for the age group of children immediately preceding entry into the primary education cycle over the last decades, but the universalization of preschool is not a reality in half of the countries of this region.

Second, despite all the Latin American countries included in this study have expanded the provision and opportunities of ECE for the age groups immediately preceding entry into the primary education cycle, the effects of preschool attendance on the later academic performance have become more diluted over time, even for the countries that have improved their scores in the last rounds of the PISA tests (e.g., Argentina). Specifically, the extent to which compulsory attendance in preschool education can mitigate the social inequalities in children's learning outcomes generated within the family context can be in question by the results of this study, as the positive correlation between the duration of early education and the later academic performance is no longer existent in some of these countries when the preschool attendance is for 1 year or less. This is due to the confronted trend of preserving positive effects on the later attainment only in the case of students that have attended more than a year of preschool among the Latin

American countries that participated in PISA. This fact, as it was warned before [10], could be an indication that preschool education, with the compulsory attendance policy, has become an early primary education in Latin America. Hence, as the effect of having been in preschool for a longer period and the impact of the socioeconomic factors influence both the duration of attendance in early education and performance on the PISA tests [21], compulsory preschool education can only reduce social inequalities in educational achievement when it is mandatory for more than 1 year prior to enter formal schooling or when the universalization of preschool is guaranteed in the earlier years. This situation has been observed in the case of Uruguay where the differential score in science per year attending preprimary school is the greatest from this region and among the highest of OECD [19]. Today, Latin American children have a higher probability of being born in poor households than 20 years ago, even though recent results in poverty reduction are quite positive [23]. Therefore, beyond compulsory attendance policies, universal good quality services are needed to reach both the lower income groups and the middle classes so as to guarantee access to those most in need [24].

A. Appendix 1

Averages for PISA mathematics scale: overall mathematics, age 15 years by Age when started [ISCED 0], year and jurisdiction: 2015.

| Jurisdiction     | 1 year or younger |        | 2 years |        | 3 years |       | 4 years |       | 5 years |       | 6 years or older |       | I did not attend [ISCED 0] |        | I do not remember |       |
|------------------|-------------------|--------|---------|--------|---------|-------|---------|-------|---------|-------|------------------|-------|----------------------------|--------|-------------------|-------|
|                  | Average           | S.E.   | Average | S.E.   | Average | S.E.  | Average | S.E.  | Average | S.E.  | Average          | S.E.  | Average                    | S.E.   | Average           | S.E.  |
| Chile            | 368               | (11.3) | 388     | (12.8) | 426     | (5.4) | 439     | (3.4) | 426     | (3.2) | 392              | (8.0) | 393                        | (9.7)  | 404               | (5.3) |
| Mexico           | 419               | (12.2) | 420     | (8.0)  | 411     | (3.1) | 413     | (2.9) | 399     | (4.1) | 384              | (6.7) | 383                        | (12.5) | 417               | (6.3) |
| Argentina (2015) | —                 | (†)    | —       | (†)    | —       | (†)   | —       | (†)   | —       | (†)   | —                | (†)   | —                          | (†)    | —                 | (†)   |
| Brazil           | 381               | (5.9)  | 406     | (7.7)  | 394     | (5.0) | 382     | (4.4) | 375     | (3.5) | 351              | (3.8) | 368                        | (7.7)  | 380               | (4.1) |
| Colombia         | 377               | (7.7)  | 402     | (6.9)  | 413     | (5.5) | 408     | (4.0) | 386     | (2.8) | 358              | (3.9) | 383                        | (8.0)  | 385               | (5.7) |
| Costa Rica       | 399               | (13.8) | 455     | (10.3) | 431     | (7.7) | 413     | (3.9) | 400     | (2.9) | 385              | (2.9) | 392                        | (6.0)  | 401               | (4.2) |
| Peru             | 393               | (9.7)  | 418     | (5.7)  | 396     | (3.1) | 390     | (4.0) | 369     | (3.6) | 330              | (6.4) | 354                        | (6.7)  | 381               | (6.1) |
| Uruguay          | 444               | (6.6)  | 462     | (4.9)  | 434     | (3.8) | 407     | (2.9) | 391     | (4.5) | 343              | (6.4) | 422                        | (14.1) | 393               | (6.2) |

Explanatory notes:

— Not available.

† Not applicable.

S. E. Standard Error.

Argentina: Coverage is too small to ensure comparability (see PISA 2015 Results [Volume I]: Excellence and Equity in Education [OECD, 2016], Annex A4). The Reading, Mathematics and Science scale ranges from 0 to 1000. Some apparent differences between estimates may not be statistically significant.

Source: By author Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2015 Mathematics Assessments.

A.1 Appendix 2

Averages for PISA reading scale: overall reading, age 15 years by Age when started [ISCED 0], year and jurisdiction: 2015.

| Year | Jurisdiction     | 1 year or younger |        | 2 years |        | 3 years |       | 4 years |       | 5 years |       | 6 years or older |       | I did not attend [ISCED 0] |        | I do not remember |       |
|------|------------------|-------------------|--------|---------|--------|---------|-------|---------|-------|---------|-------|------------------|-------|----------------------------|--------|-------------------|-------|
|      |                  | Average           | S.E.   | Average | S.E.   | Average | S.E.  | Average | S.E.  | Average | S.E.  | Average          | S.E.  | Average                    | S.E.   | Average           | S.E.  |
| 2015 | Chile            | 396               | (10.3) | 395     | (17.0) | 461     | (5.9) | 476     | (3.1) | 464     | (3.4) | 433              | (8.3) | 421                        | (9.3)  | 438               | (5.5) |
|      | Mexico           | 433               | (13.5) | 436     | (8.9)  | 426     | (3.4) | 425     | (3.5) | 419     | (4.0) | 393              | (6.8) | 389                        | (9.3)  | 434               | (7.3) |
|      | Argentina (2015) | —                 | (†)    | —       | (†)    | —       | (†)   | —       | (†)   | —       | (†)   | —                | (†)   | —                          | (†)    | —                 | (†)   |
|      | Brazil           | 411               | (5.8)  | 437     | (6.1)  | 426     | (4.9) | 414     | (4.1) | 408     | (4.2) | 376              | (4.4) | 397                        | (7.0)  | 413               | (4.0) |
|      | Colombia         | 394               | (9.3)  | 440     | (8.3)  | 454     | (5.8) | 449     | (4.6) | 419     | (3.6) | 393              | (4.2) | 419                        | (9.4)  | 419               | (5.9) |
|      | Costa Rica       | 439               | (17.7) | 479     | (10.1) | 471     | (7.9) | 443     | (4.7) | 427     | (3.0) | 410              | (3.4) | 421                        | (4.6)  | 425               | (4.6) |
|      | Peru             | 408               | (10.7) | 435     | (6.0)  | 410     | (3.5) | 401     | (3.9) | 377     | (4.3) | 334              | (7.5) | 349                        | (6.6)  | 392               | (6.8) |
|      | Uruguay          | 462               | (7.2)  | 488     | (5.5)  | 458     | (3.7) | 423     | (2.9) | 409     | (5.0) | 351              | (6.9) | 404                        | (15.3) | 411               | (6.4) |

Explanatory notes:

— Not available.



†Not applicable.  
S. E. Standard Error.

Argentina: Coverage is too small to ensure comparability (see PISA 2015 Results [Volume I]: Excellence and Equity in Education [OECD, 2016], Annex A4). The Reading, Mathematics, and Science scale ranges from 0 to 1000. Some apparent differences between estimates may not be statistically significant.

Source: By author Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2015 Reading Assessments.

A.2 Appendix 3

| Averages for PISA science scale: overall science, age 15 years by Age when started [ISCED 0], year and jurisdiction: 2015 |                  |                   |        |         |        |         |       |         |       |         |       |                  |       |                            |        |                   |       |
|---|------------------|-------------------|--------|---------|--------|---------|-------|---------|-------|---------|-------|------------------|-------|----------------------------|--------|-------------------|-------|
| Year  | Jurisdiction     | 1 year or younger |        | 2 years |        | 3 years |       | 4 years |       | 5 years |       | 6 years or older |       | I did not attend [ISCED 0] |        | I do not remember |       |
|   |                  | Average           | S.E.   | Average | S.E.   | Average | S.E.  | Average | S.E.  | Average | S.E.  | Average          | S.E.  | Average                    | S.E.   | Average           | S.E.  |
| 2015  | Chile            | 392               | (10.6) | 405     | (13.0) | 451     | (5.3) | 461     | (3.1) | 452     | (2.8) | 422              | (6.4) | 411                        | (8.3)  | 433               | (4.2) |
|   | Mexico           | 428               | (12.3) | 433     | (6.7)  | 419     | (2.9) | 416     | (2.4) | 409     | (3.5) | 389              | (6.1) | 401                        | (9.1)  | 432               | (5.9) |
|   | Argentina (2015) | —                 | (†)    | —       | (†)    | —       | (†)   | —       | (†)   | —       | (†)   | —                | (†)   | —                          | (†)    | —                 | (†)   |
|   | Brazil           | 406               | (5.8)  | 430     | (5.8)  | 415     | (3.9) | 405     | (3.3) | 399     | (3.0) | 373              | (3.0) | 400                        | (6.4)  | 405               | (2.9) |
|   | Colombia         | 396               | (7.9)  | 430     | (6.6)  | 441     | (4.8) | 434     | (3.8) | 409     | (2.8) | 388              | (3.3) | 408                        | (7.0)  | 416               | (4.8) |
|   | Costa Rica       | 424               | (15.0) | 469     | (8.7)  | 460     | (7.6) | 435     | (3.9) | 417     | (2.3) | 407              | (2.5) | 415                        | (4.6)  | 416               | (3.7) |
|   | Peru             | 405               | (9.2)  | 426     | (4.9)  | 405     | (2.7) | 399     | (3.1) | 381     | (3.3) | 357              | (6.2) | 361                        | (5.7)  | 395               | (5.6) |
|   | Uruguay          | 460               | (6.5)  | 478     | (4.0)  | 453     | (3.1) | 424     | (2.6) | 404     | (3.7) | 365              | (5.6) | 421                        | (12.6) | 421               | (5.8) |

Explanatory notes:  
— Not available.  
†Not applicable.  
S. E. Standard Error.

Argentina: Coverage is too small to ensure comparability (see PISA 2015 Results [Volume I]: Excellence and Equity in Education [OECD, 2016], Annex A4). The Reading, Mathematics, and Science scale ranges from 0 to 1000. Some apparent differences between estimates may not be statistically significant.

Source: By author Organization for Economic Cooperation and Development (OECD), Program for International Student Assessment (PISA), 2015 Science Assessments.

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