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Policy Brief

Is participation in preschool education associated with higher student achievement?

Contents

Summary

Preschool education is a major topic on many national educational agendas. Countries and supranational organizations have promoted reforms aimed at readying children for entry into formal schooling, and preschool coverage rates have steadily increased in recent decades.

In this policy brief we analyze data from 37 education systems that participated in the last round of the IEA's Trends in International Mathematics and Science Study (TIMSS 2011). Our aim is to examine the relationship between participation in preschool education and mathematics achievement at Grade 4.

Policy implications

1. *Preschool coverage rates are relatively high across countries.* Coverage rates do vary across countries, but preschool education was available in all the analyzed countries. On average across these countries, almost 90 percent of students had participated in some form of preschool education, according to their parents.
2. *Participation in preschool education is associated with higher average mathematics achievement in Grade 4:* Our analyses suggest that, at least in some countries, preschool education can be an effective way to help children prepare for school. Regardless of the student's family background, the level of participation in preschool education was positively and significantly associated with mathematics achievement in Grade 4 in almost one half of the analyzed countries.
3. *Policymakers should recognize that multiple factors contribute to student learning:* We analyzed only two possible influences on student achievement: participation in preschool education and the socioeconomic background of students. However, other known factors such as parental involvement or teacher and school characteristics, also play an important role in predicting educational achievement. We therefore urge policymakers involved in designing intervention policies aimed at improving learning outcomes to shape those policies according to in-depth, context-based analyses.

Introduction

Preschool education is a major topic on many national educational agendas. A number of countries and supranational organizations have promoted reforms aimed at readying children for entry to formal schooling (Naudeau et al., 2011). The European Union, for example, has in place a project called Cre*ative Little Scientists: Enabling Creativity through Science and Mathematics in Preschool and First Years of Primary Education (*European Commission, 2013). In the United States, President Obama has announced a plan to "make high quality preschool available to every single child in America" (The White House, 2013). A recent report from the Economist Intelligence Unit (Watson, 2012) suggests that preschool education strengthens children's readiness for school and life, and points to studies which indicate that high-quality preschool programs save society significant amounts of money over time. The report suggests that, for the reasons mentioned above, preschool education is becoming more common at the international level.

According to the 2011 cycle of the TIMSS, the 77 participating education systems indicated that preschool education was available in their countries. Many countries reported that even though attending preschool education was voluntary, it was a fundamental part of their education systems. Most of the TIMSS 2011 participants also reported having a national preschool curriculum that included both mathematics and science. Additionally, beyond the 10 countries reporting that preschool education was mandatory, a number of other education systems, among them the Dutch-speaking community of Belgium, Chinese Taipei, Croatia, England, Portugal, Romania, Singapore, and Sweden, said that nearly all children attended preschool (Mullis et al., 2012b).

Furthermore, the TIMSS 2011 international report (Mullis et al., 2012a) provides evidence of an association between educational achievement and participation in preschool education across the participating education systems. On average, those students who participated in preschool had higher achievement in mathematics at Grade 4 than those who did not. In this policy brief, we use data from TIMSS 2011 to probe more deeply into the relationship between participation in preschool and educational achievement.

Data

We analyzed data from the 37 TIMSS 2011 education systems for which valid information on preschool attendance was available. [1] This study assessed student achievement in mathematics and science at Grades 4 and 8 in 63 countries and 14 states or regions. In addition to administering achievement tests, TIMSS used questionnaires completed by children, teachers, parents, school principals, and the TIMSS national research coordinators in each country to explore educational contexts. TIMSS 2011 offered us a particularly good opportunity to analyze the topic of this policy brief because the TIMSS dataset contains internationally comparable information about students' participation in preschool education (as reported by their parents) and students' mathematics achievement in Grade 4. We caution, however, that due to the cross-sectional nature of the data, the analyses presented here are correlational in nature and should not be used to infer causality.

Percent of fourth graders who attended preschool education and their average achievement in mathematics

Research evidence suggests that preschool education, in the form of kindergarten or an early childhood education program, plays an important role in children's future mathematics achievement (see, for example, Melhuish et al., 2008). As economies shift toward more knowledge-based activities, the recognition of the importance of improving children's social awareness, group interaction skills, and preparedness for starting primary education continues to grow (Watson, 2012). Consequently, preschool education participation rates have been steadily rising in most countries since the 1990s. According to the TIMSS 2011 international report (Mullis et al., 2012a), on average, 87 percent of fourth graders attended some form of preschool education in the participating countries. But are the education systems which have achieved high preschool education coverage rates also seeing higher educational performance? In this section we investigate whether high levels of participation in preschool education are accompanied by high national averages in mathematics achievement at Grade 4.

Figure 1 shows the average performance in mathematics of the education systems in TIMSS 2011 at Grade 4. The education systems are divided into two groups: those where 90 percent or more of the students attended some form of preschool (blue bar, 20 education systems), and those where fewer than 90 percent of the students had attended any form of preschool (green bar, 18 education systems).

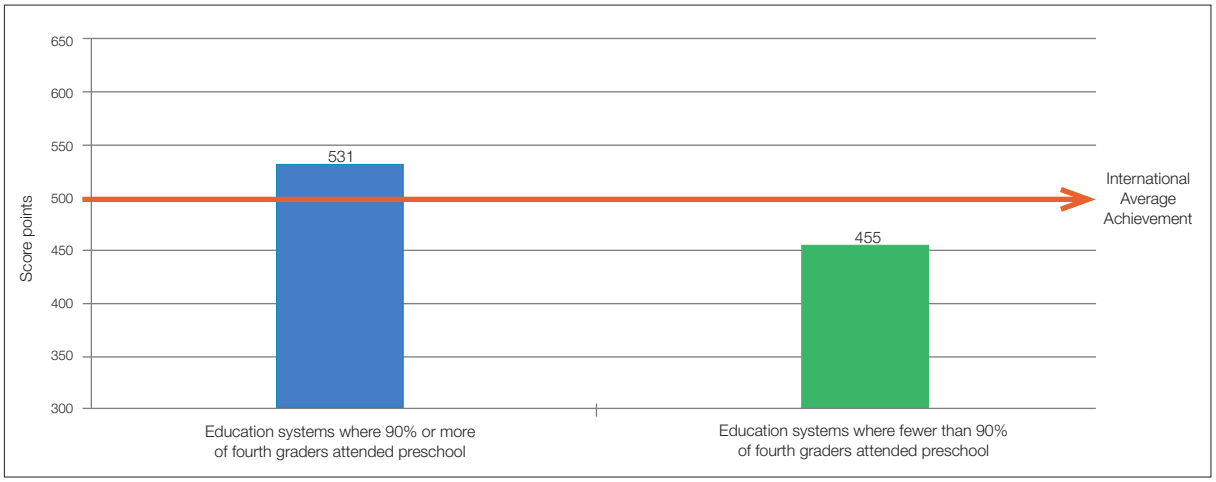
The chart shows that in TIMSS 2011, the group of countries where the great majority of Grade 4 students had participated in preschool education had an average mathematics score well above the international average (531), while the group of countries where fewer than 90 percent of the children had attended preschool education had a score well below the international average (455). The difference between the average score of both groups was close to one standard deviation (76 score points). [2] This is an important difference, particularly when one considers that the range for the average scores for all the education systems analyzed here is less than three standard deviations. [3] In other words, those education systems where the great majority of children participated in some form of preschool education obtained significantly higher average mathematics scores in TIMSS 2011 than did those with lower participation rates. Of course, a higher rate of participation in preschool education is not the only reason why education systems perform better, but we will address this point in the next section.

1 Australia, Austria, Azerbaijan, Botswana, Canada (Québec), Chinese Taipei, Croatia, Czech Republic, Finland, Georgia, Germany, Honduras, Hong Kong SAR, Hungary, Islamic Republic of Iran, Ireland, Italy, Lithuania, Malta, Morocco, Northern Ireland, Norway, Oman, Poland, Portugal, Qatar, Romania, Russian Federation, Saudi Arabia, Singapore, Slovak Republic, Slovenia, Spain, Sweden, United Arab Emirates, United Arab Emirates (Abu Dhabi), United Arab Emirates (Dubai).

2 TIMSS scores are reported on a theoretical scale that ranges from 0 to 1,000, with an international mean of 500 and a standard deviation of 100.

3 Within the group of education systems analyzed in this policy brief, Singapore had the highest Grade 4 mathematics average performance (606) and Morocco the lowest (335).

Figure 1: Average performance in mathematics, Grade 4 students (TIMSS 2011)



Source: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS) 2011.

Is participation in preschool education associated with achievement regardless of social background?

The positive association between preschool education and average mathematics achievement is also confirmed by the results of other major international studies, most notably the Programme for International Student Assessment (PISA) (OECD, 2013) and the Progress in International Reading Literacy Study (PIRLS) (Mullis et al., 2012c). Other recent studies using longitudinal analyses carried out in England and the United States also show positive associations between participation in preschool education and academic achievement (Sammons et al., 2002; Tucker-Drob, 2012).

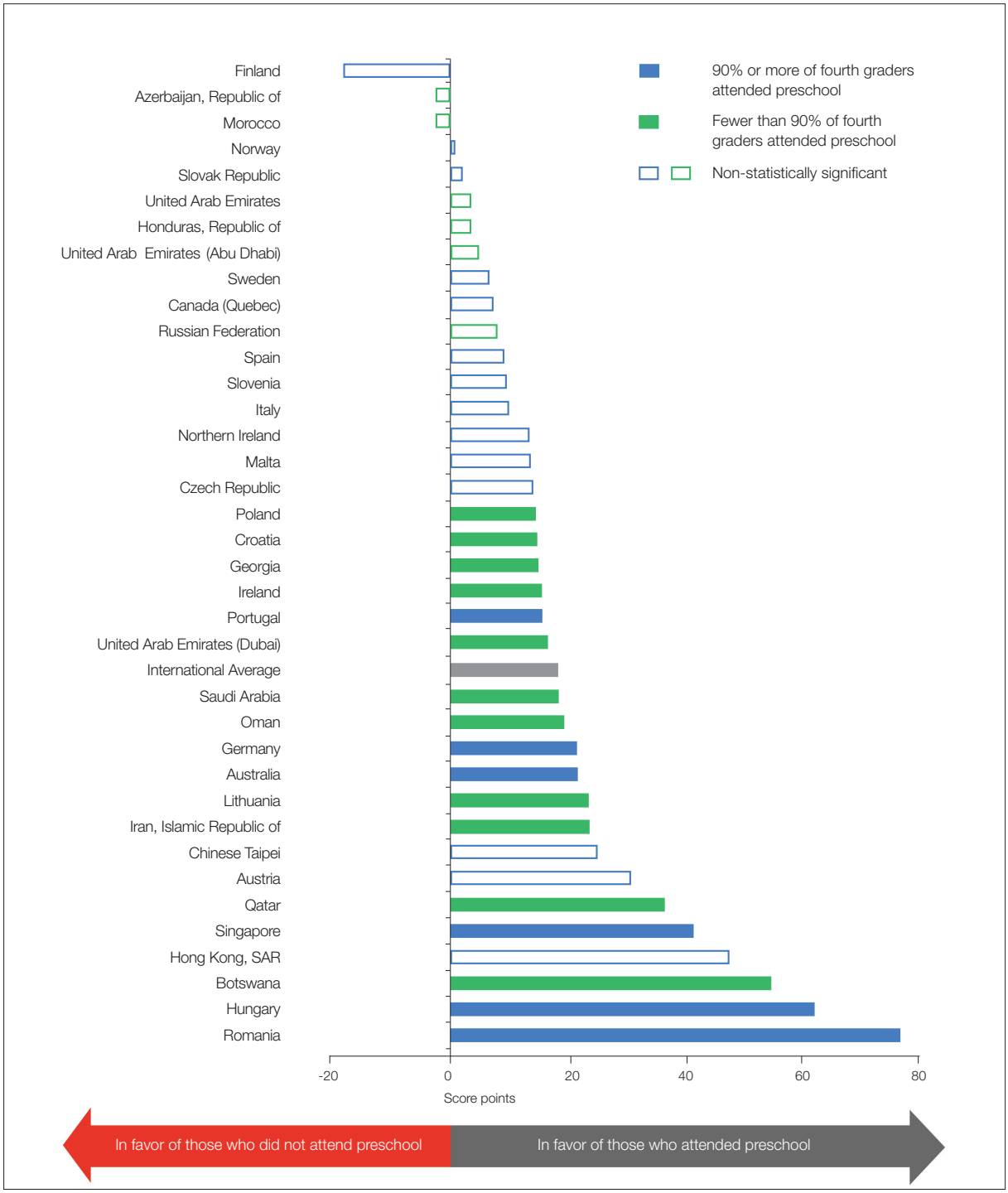
Participation in preschool education is not, of course, the only factor that influences students' academic achievement. Socioeconomic background is considered to be one of the main factors influencing children's ability to take advantage of preschool (UNESCO, 2012). Figure 2 shows the differences in average mathematics achievement among the TIMSS 2011 fourth graders associated with participation in preschool education after accounting for the impact of socioeconomic background.[4] In other words, if all students had the same socioeconomic background, what would the expected difference in mathematics achievement associated with participating in preschool education be?

The differences are positive when they are in favor of those students who attended preschool education, and negative when they are in favor of those who did not. Statistically significant differences are represented by colored bars, and non- significant ones by blank bars. Like in Figure 1, education systems where 90 percent or more of the students attended some form of preschool are represented by blue bars, and those where fewer than 90 percent of the students did are represented by green bars.

We found statistically significant differences in 17 education systems: Poland, Croatia, Georgia, Ireland, Portugal, United Arab Emirates (Dubai), Saudi Arabia, Oman, Germany, Australia, Lithuania, Iran, Qatar, Singapore, Botswana, Hungary and Romania. In these 17 education systems the differences were in favor of those who attended preschool education and ranged from 14 score points in Poland to 76 in Romania. These findings suggest that, in these education systems, regardless of the socioeconomic background of the students, gains in mathematics achievement were associated with participation in preschool education. From the remaining education systems analyzed here, seventeen more reported positive associations and three reported negative ones, but none of those reached statistical significance.

4 The information about socioeconomic background was collected from students' responses to questions concerning availability of home resources (number of books and number of home study supports) and their parents' responses to questions on the number of children's books in the home, parental level of education, and parental occupation.

Figure 2: Differences in the average mathematics achievement of fourth graders associated with their participation in preschool education (after accounting for socioeconomic background)



Source: International Association for the Evaluation of Educational Achievement (IEA), Trends in International Mathematics and Science Study (TIMSS) 2011.

Conclusions and policy implications

1. *Preschool coverage rates are relatively high across countries.*

   While preschool education was available in 77 education systems participating in TIMSS 2011, the proportions of children attending preschool varied. In 20 (out of 37) of the education systems for which data on preschool attendance is available, 90 percent or more of the fourth graders had attended some form of preschool education. On average, these countries performed significantly better in mathematics in TIMSS 2011 than the others

2. *Participation in preschool education is associated with higher average achievement in Grade 4.*

   Our analyses suggest that, at least in some countries, preschool education can be an effective way to help children prepare for school. As shown in Figure 2, students, regardless of their family background, were more likely to gain higher mathematics achievements scores in Grade 4 if they had participated in preschool. This association between level of participation in preschool education and mathematics achievement was positive and statistically significant in almost half of the analyzed countries. In those countries, if all students had the same socioeconomic background, we could expect those who participated in preschool education to have performed significantly better than those who did not attend any form of preschool education.

3. *Policymakers should recognize that multiple factors contribute to student learning.*

   This policy brief has analyzed only two possible influences on student achievement: participation in preschool education and socioeconomic background of students. However, other known factors such as teacher and school characteristics (see, for example, Hattie, 2009), also play an important role in predicting educational achievement.

   Our analyses suggest that preschool education plays a role in later learning outcomes, but more work needs to be done to identify other factors that could influence the contribution of preschool education.[5] It would also be advisable to test well-formulated hypotheses with longitudinal datasets. Ideally, randomized trials should be conducted on the best programs in order to tease out unobserved influences on learning (Loveless, 2013). Those influences may include factors that determine the quality of preschool programs. For example, a recent randomized evaluation from the United States found positive effects of a preschool program for socially disadvantaged children at the end of kindergarten. However, the same study reported that such effects had completely faded away by the end of first grade. (Lipsey et al., 2013). Policymakers involved in designing intervention policies aimed at improving learning outcomes to should be guided by an in-depth understanding and context-based analysis of local circumstances.

5 The IEA Early Childhood Education Study (ECES) will examine the relationships between policy aims, family background, and ECE provision. For more information see: http://eces.iea.nl/

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