Propósitos y Representaciones
Ene.-Jun. 2016, Vol. 4, N° 1: pp. 363-384.
http://dx.doi.org/10.20511/pyr2016.v4n1.93

ISSN 2307-7999
e-ISSN 2310-4635

Learning in primary-first-to-sixth grade students about reading and mathematics and the need to correct the national curriculum of studies

Los aprendizajes de primero a sexto de primaria en lectura y matemática y la necesidad de sincerar el currículum nacional de estudios

Federico R. León

Universidad Científica del Sur, Lima, Perú.

Received: 18-09-15
Approved: 04-01-16

Correspondencia

Email: federicorleone@gmail.com

Citar como:

León, F. (2016). Learning in primary-first-to-sixth grade students about reading and mathematics and the need to correct the national curriculum of studies. *Propósitos y Representaciones, 4*(1), 363-384. doi: http://dx.doi.org/10.20511/pyr2016.v4n1.93

In his recent review of the national research on the education field, Rodriguez (2013) identified six general subjects that, in order of volume and productive wealth, seem to differentiate the first category-factors associated with school performance and attendance from the following categories: teacher training, teaching practices and classroom performance, learning resources, decentralization of education management and participation, funding and returns to education. In the very important first category, results (obtained by standardized tests) showed a very poor performance in general and uneven results at the same time. For example, in 2010, learning expectations in second grade were only achieved by 29% of students in reading comprehension and 14% in mathematics, in groups of urban-rural and private-state schools in the order of 28% and 26% respectively. The publication *Reading and Mathematics learning in students from first to sixth grade. A longitudinal study carried out in state educational institutions in Metropolitan Lima*, that has just been introduced by the Department of Learning Quality Measurement of the Ministry of Education of Peru (August 11, 2015), and that is the reason of this review, confirms several previous findings, but it brings some surprises as well.

The most significant fact about this study is its methodological sophistication. The challenges of a longitudinal research are so complex that even the most educated reader could have difficulties understanding it. Burga, Arámbulo, Bardales, Mark, Ozejo, Pacheco, Simon, Sosa and Terrones, the researchers in charge of the study, address this issue with an uncommon ability. The longitudinal study has more advantages than the transverse study when separating the cohort effect from the age effect. As the authors indicate, this separation is needed because older students, those who have failed more times and those with lower performance are more likely to drop out of the system. Burga et al. defined their population as all students that in 2007 were enrolled in 1st grade of primary state schools of Lima, with at least 20 students per class. They also kept track of that cohort in the following grades of elementary education. Their initial sample, achieved with great

Propósitos y Representaciones
Ene.-Jun. 2016, Vol. 4, N° 1: pp. 363-384.
http://dx.doi.org/10.20511/pyr2016.v4n1.93

calculations accuracy, was 821 educational institutions that grouped 75,976 students in that grade. In addition to the scope of the logistics operation and maintenance over the years, researchers had to face a difficult psychometric problem. Items used in achievement tests to evaluate students of 2nd grade could not be the same as those used with 6th grade students. The solution implemented by Burga et al. to achieve a common measure across primary education was the vertical scaling. This consisted of including in the higher grade (e.g. 2nd grade) 25% of items that were the most difficult to solve in the previous grade (as in the example, 1st grade). It means that the items of each grade included a percentage of items in common with the previous grade and the following grade. The psychometric analysis of the applied tests was based on the "Partial Credit" Rasch model.

Topics covered were reading and mathematics skills. The approach used by the Ministry of Education in the first field is the communication skills development, rather than the traditional morphosyntactic analysis. The specific skills evaluated were: Identification of literal information, inference and interpretation of meanings, reflection and evaluations of texts. These texts were narrative, descriptive, expository, argumentative and instructive. Continuous and discontinuous formats were used. The criteria for adjusting the texts complexity were those of thematic, semantic and programmatic relevance, amount of information, grammatical, lexical and syntactic relevance, and graphic adaptation. Recreational, public and educational uses of reading were also taken into account. In the mathematical area, the Ministry of Education has a solving problems approach that is not limited to a thematic teaching, but it also seeks to enhance cognitive skills and critical attitude. Three specific skills were evaluated: problem solving (using mathematical knowledge in a flexible way to face a complex situation that requires formulating strategies, making decisions and reflecting on the relevance of the response), mathematical communication (use of symbols, tables, diagrams and other representation diagrams of mathematical type) and application of algorithms (procedures for dealing with situations such

as those involved in adding, subtracting, multiplying and dividing natural, decimal and fractional numbers). The items contents included numbers, relationships and operations, geometry and statistics, in intra-mathematical contexts (with mathematical objects) and extra-mathematical contexts (reality simulations).

On the other hand, the study included associated factors, as in international studies like PISA and TIMSS. Thus, they included student-related variables (gender, early childhood education, parent-child communication, parental involvement in school activities and socioeconomic aspects), teaching-related variables (education level, training and experience, assessment of teaching work, collective work, satisfaction and self-efficacy) and school-related variables (infrastructure and pedagogical period). When analyzing the data, researchers distinguished the statistical significance (virtually irrelevant in a sample with such a number of cases) from the effect size (expressed in standard deviation units).

The main results of the study show a learning non-linear growth, growing gaps between what is expected and what is achieved, and limited influence of associated factors. The learning growth curves observed over time in the study of Burga et al., presenting a nonlinear configuration, indicate that increases between years are not the same, but increasingly lower. The researchers do not attempt to explain this learning curves configuration, they only state that the quadratic equation configure them adequately. However, international literature suggests that there are certain learning studies that can account for the findings in Lima. One of which refers to non-linear curves and it has generated a search for a non-linear model that better reflects the evidence. Brooks and Meltzoff (2008) performed a study on vocabulary development on infants from 10 months to 2 years old, and they concluded that a quadratic model was the most appropriate. Jones et al. (2005) performed a study on senior citizens about their memory of a list of words displayed in several trials. Although they found a quadratic adjustment, they questioned it

Propósitos y Representaciones
Ene.-Jun. 2016, Vol. 4, N° 1: pp. 363-384.
http://dx.doi.org/10.20511/pyr2016.v4n1.93

in conceptual terms since this model involves improvements in the learning process followed by a decline; therefore, they rather suggested a logarithmic model that best represents the declining improvements that reaches a asymptote or plateau. Larsen-Freeman and Cameron (2008) also argue that human learning is not linear. The most similar study to the one of Burga et al. is the study of Veerhoeven and Van Leeuwe (2009). This study had a sample of 2819 Dutch children whose reading comprehension was assessed twice a year during a period of five years, from 1st to 6th grade. A logarithmic model presented a better modeling than the quadratic, cubic or linear models. This international evidence is important because it places the findings of Burga et al. in a broad perspective that shows us that results obtained in Lima do not represent peculiarities to Peruvian education and, therefore are far from particular explanations. For example, on the date of the book's presentation, some commentators stated that the students declining performance could be reflecting the efforts made by the Ministry Education of Peru on teachers training, which have focused on the early grades of primary education. It should be doubted that training efforts to improve teaching competence in dealing with the most advanced primary school grades can convert the non-linear curves of Burga et al. in linear curves. If this is achieved, it would undoubtedly constitute a striking singularity in the global picture of learning curves.

The second main finding is probably the one that has more implications in Peru's educational strategies. In reading comprehension, and especially in mathematics, the longitudinal study shows that, in reference to the learning outcomes set in the curriculum documents for each grade, the students' achievements are increasingly more distant than expected. The gap in the last three grades of primary school is always higher than in the first three grades. Generally, students achieve the learning goals long after the expected time or fail to achieve them. The authors of the study recommend "to take advantage of the findings ... to guide the curricular attention on how and how much the students' education progresses throughout their schooling

in primary school. This insight, based on evidence, could provide clear criteria for adjusting each grade curriculum expectations on what students are expected to learn"(p. 104). Again, if the study findings are placed in the broader context of international evidence, we can have a better understanding of the situation and outline more specific recommendations. First, it is known that heredity and environmental effects on intellectual functions are not the same at different ages (Nisbett, Aronson, Blair, Dickens, Flynn et al., 2012). For example, environmental effects appear as early as at 10 months of age, and hereditary effects appear at 2 years of age (Tucker-Drob, Rhemtulla, Harden, Turkheimer & Fasl, 2011). The heritability of intelligence increases from 41% in childhood to 55% in adolescence and 64% in early adulthood (Haworth, Wright, Luciano, de Geus, van Beijstervedt et al., 2010). Bouchard (2013) also showed that the heritability of IQ increases with age and reaches its asymptote at age 18-20. McClearn, Johansson, Berg, Pedersen, Ahern, Petrill & Plomin (1997) had already noticed that, after 80 years of age, heritability reaches 62%. There are important implications since, paradoxically, the cognitive effects of heredity occur later than the environmental effects. The growing gap between the observed performance and the one expected in the children studied by Burga et al. probably reflects the increasing impact of heredity in intellectual functioning. That is, the more students advance in primary school, the more limitations imposed by genetics emerge. This interpretation is consistent with the PISA tests results, where 15 year-old Peruvian students achieved lower reading and mathematics results than those of comparable groups from developed countries and even Latin American students (Cueto, 2007). It is of the utmost importance to note that while PISA tests standards come from developed countries, the results of Burga et al. arise from comparisons with national standards. The next logic question is: Where do the educational standards of the Ministry of Education of Peru come from? Do they accept the fact that school performance required from Peruvian children have to be the one from the First World (as the national standards seem to be)? The findings of Burga et al. give the impression that a child from Lima does not achieve the educational standards since these

Propósitos y Representaciones
Ene.-Jun. 2016, Vol. 4, N° 1: pp. 363-384.
http://dx.doi.org/10.20511/pyr2016.v4n1.93

may be appropriate for the type of development of an English or Japanese child, but not for a local child. If this is so, the main recommendation of the study should be to shift from the faint "curricular orientation on how and how much the student education progresses throughout their schooling" to outline the pressing need to shed light on the primary education curriculum and adapt it to the Peruvian capabilities children. Otherwise, the high level of school dropouts will continue by discouraged students due to their academic failure, and universities will continue admitting students who are not able to put three coherent sentences together. If the curriculum is modified, the expected results deceleration will have to be compensated by adding perhaps an extra year in secondary school; and by looking for creative solutions for the minority types of schools such as private-selected schools of Lima whose students surely surpass the English or Japanese average. In the light of the evidence, I think that Peru and, generally speaking, "developing" countries should acknowledge that what it takes six years to a European or Oriental child with better genetic endowment and environmental conditions (Leon & Burga-León, 2015; Manrique, 2015) may take seven years to the majority of children from a tropical country. By doing this we could aspire to create more competent citizens, which is what ultimately matters. Although education in far from perfect, international evidence strongly suggests that increasing the school day or adding an extra year of formal education produces positive educational outcomes (Patall, Cooper & Allen, 2010). With the proper curricular programming we can aspire that the Peruvian *adult*, even if it takes longer, shortens the intellectual distances with English or Japanese adults; although Peruvian *children* are far from their counterparts in other latitudes.

These recommendations are strongly supported by the third major finding of the longitudinal study. This finding shows that with the improvement efforts aimed at students, the teacher or school would not be able to significantly bring closer students of government schools to the curriculum standards of the Ministry of Education. Besides the statistical significance of gender differences, cultural capital, teaching experience,

evaluation of teaching, etc., the effects sizes were insignificant. That is, the associated factors explain little or nothing about school performance among government school students in Lima. This does not mean that future school interventions using some of these factors have to be necessarily unsuccessful but, given the extent of the gaps between what is achieved and what is expected in each grade of elementary school, inputs may not close these gaps, at least not in Lima.

During the book's presentation, commentators attributed the lack of academic impact of associated factors to the homogeneity of the sample, referring that, if the variance to be explained is small, then the evaluated impacts will tend to be small. It is precisely this characteristic of homogeneity of the longitudinal study sample what should guide our attention and judgment to what may be happening in the rest of the country. Due to historical, geographic and climatic causes (Leon & Burga León, 2014) the city of Lima, of a country whose government was until recently highly centralized, presents a school performance level higher than that of the northern coast of Peru, and that of almost all the highlands and jungle areas. That is the gaps in the rest of Peru between expected and achieved outcomes are even bigger than those seen in Lima. If the primary education curriculum is unsuitable for Lima, then it is extremely far from reality inside the country. Over there, good outcomes can be expected from conventional educational interventions, since the academic, social and geographic variances are large. However, the greatest impact would be to shed light on the curriculum.

The only are of the study presented that does not meet the expectations is the area of individual differences. The study was focused on averages, thus it is not possible to know if, for example, the 25% academically superior children of the 1st grade of primary school meet the curriculum requirements in 6th grade, or how far the inferior 25% can get. There would also be clear implications of the findings in this area for the education reorganization, adapting it better to reality. Fortunately, this aspect can be overcome by

Propósitos y Representaciones
Ene.-Jun. 2016, Vol. 4, N° 1: pp. 363-384.
http://dx.doi.org/10.20511/pyr2016.v4n1.93

further research to continue taking advantage of the rich database provided by the study. The researchers' expertise so guarantees it.

References

Bouchard Jr., T. J. (2013). The Wilson Effect: The increase in heritability of IQ with age. *Twin Research and Human Genetics, 16*, 923-930.

Brooks, R., & Meltzoff, A. N. (2008). Infant gaze following and pointing predict accelerated vocabulary growth through two years of age: a longitudinal growth curve modeling study. *Journal of Child Language, 35,* 207-220.

Cueto, S. (2007). Las evaluaciones nacionales e internacionales de rendimiento escolar en el Perú: Balance y perspectivas. En GRADE, *Investigación, políticas y desarrollo en el Perú*. Lima: Grupo de Análisis para el Desarrollo.

Haworth, C. M. A., Wright, M. J., Luciano, M., de Geus, E. J. C., van Beijstervedt, C. E. M., et al. (2010). The heritability of general cognitive ability increases linearly from childhood to young adulthood. *Molecular Psychiatry, 15,* 1112-1120.

Jones, R. N., Rosenberg, A. L., Morris, J. N., Allaire, J. C., McCoy, K. J. M., Marsiske, M., Kleinman, K. P., et al. (2005). A growth curve model of learning acquisition among cognitively normal older adults. *Experimental Aging Research*, 2005, 31, 291-312.

Larsen-Freeman, D., & Cameron, L. (2008). Research methodology on language development from a complex systems perspective. *Modern Language Journal*, *92*, 200-2013

León, F. R., & Burga León, A. (2014). Why complex cognitive ability increases with absolute latitude. *Intelligence*, *46,* 291–299.

León, F. R., & Burga-León, A. (2015). How geography influences complex cognitive ability. *Intelligence, 50,* 221-227.

Manrique Millones, D. (2015). Intelligence in Peru: Students' results in Raven and its relationship to SES. *Intelligence, 51,* 71-78.

McClearn, G. E., Johansson, B., Berg. S., Pedersen, N. L., Ahern, F., Petrill, S. A., & Plomin, R. (1997). Substantial genetic influence on cognitive abilities in twins 80 or more years old. *Science*, *276,* 1560-1563.

Nisbett, R. E., Aronson, J., Blair, C., Dickens, W., Flynn, J., Halpern, D. F., et al. (2012). Intelligence: New findings and theoretical developments. *American Psychologist*, *67*, 130–159.

Patall, E. A., Cooper, H., & Allen, A. B. (2010). Extending the school day or the school year: A systematic review of research (1985-2009). *Review of Educational Research, 80,* 401-436.

Rodríguez, J. A. (2013). La investigación nacional en educación 2007-2011. Balance y agenda. *Propósitos y Representaciones*, *1*(1), 131-151.

Tucker-Drob, E. M., Rhemtulla, M., Harden, K. P., Turkheimer, E., & Fask, D. (2011). Emergence of a gene x socioeconomic status interaction on infant mental ability between 10 months and 2 years. *Psychological Science*, *22,* 125-133.

Verhoeven, L., & van Leeuwe, J. 2008. Prediction of the development of reading comprehension: A longitudinal study. *Applied Cognitive Psychology, 22,* 407-423.

Propósitos y Representaciones
Ene.-Jun. 2016, Vol. 4, N° 1: pp. 363-384.
http://dx.doi.org/10.20511/pyr2016.v4n1.93