Integration of Schools in Latvia and Estonia Using Curriculum Reforms

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Abstract. This article investigates into the reform of national school curriculum in Russian-language schools in Latvia and Estonia. We assess how well the reform-related regulations have been integrated into everyday schooling practices and reflected in educational outcomes in order to measure the success of the education reform in terms of curriculum acceptance and PISA result improvements. The study exploits the situation of natural experiment that followed the collapse of the Soviet Union, with countries that used to have a common education system taking different reform paths and achieving different outcomes. National school curriculum is analyzed at three levels: as intended (stipulated in documents), as implemented (taught by school teachers), and as attained (reflected in test results). Such three-level analysis required studying the documents that described the key reform provisions, conducting a series of in-depth interviews in Russian-language schools to investigate the process of integrating the proposed innovations in teaching practices, and analyzing how PISA results in Latvia and Estonia had changed between 2006 and 2015. It is shown that the gap between the intended and attained curriculum has reduced in both countries. Schools have been actively integrating the changes proposed, and PISA results have been improving consistently, yet the methods of achieving those results differ between the countries. The natural experiment study design allowed to explore educational reform processes in the two countries as well as to assess the effects of the reforms introduced.

Keywords: school education reforms, post-socialist countries, PISA, comparative research in education, reform analysis methodology, national curriculum.

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The collapse of the Soviet Union was followed by dramatic transformations in all aspects of life in the post-Soviet and, on a broader scale, post-socialist countries whose population found it hard to accept many of the changes. In particular, challenges emerged in building new education systems. Integration of ethnic Russians became one of the major problems in former Soviet repub-

lics[1]. First of all, the status of Russians changed remarkably in the early 1990s. After the dissolution, they went all the way down from the Union-wide top of the socioeconomic ladder to ethnic minority groups, losing their linguistic, employment and other privileges [Rannut 1991; Raun 2009; Vihalemm, Hogan-Brun 2013]. Second, some of the former Soviet republics had been ethnically homogeneous before they became part of the Soviet Union—which means that they had little bilingual experience and very few strategies for establishing social institutions in a society with a large ethnic minority group [Bureau central de statistique de l'Estonie 1937]. In the Baltic countries—Latvia, Estonia, and Lithuania—linguistic and ethnic integration was a vital concern of education policy development [OECD2001a; Silova 2002a].

National school curriculum is a crucial component of such integration; it implies that every school student in a country acquires roughly the same set of knowledge and skills in uniform learning environments [Heyneman 1998; Heyneman, Catlaks, Dedze 2001; Livingstone et al. 1986; Njeng'ere 2014]. Integration of Russian-speaking minority groups into national education systems was the goal of Russian-language school reforms in general and curriculum reforms in particular. By the time the reforms were initiated, Latvian and Estonian majority-language schools had already elaborated new systems of educational values based on the constructivist approach to learning and learner-centered education and were ready to disseminate those new practices to the whole education system.

Previous research on national school curriculum demonstrates that its actual content and effects can only be assessed with a three-tier approach: what official documents prescribe and what society would like to see taught (the intended curriculum), what is actually taught in the classroom and how teachers incorporate all the curriculum components in their everyday classroom practices (the implemented curriculum), and what students have learnt (the attained curriculum). The three dimensions of curriculum can never overlap fully, the overlapping degree being an important indicator of curriculum integration in real school life [Bempechat, Jimenez, Boulay 2002; Livingstone et al. 1986; Martin 1996]. This study compares all the three manifestations to analyze the process of new curriculum im-

[1] When the Soviet Union recognized the independence of Latvia and Estonia in 1991, Russians were the largest ethnic minority group in both countries. The best part of Russian-speaking population had migrated to the Baltic states during the Soviet era. According to census bureau reports, ethnic Russians in Estonia accounted for 8% in 1934, 30% in 1989, and 26% in 2000. A similar trend is observed in Latvia with its 9% of ethnic Russians in 1935, 34% in 1989, and 30% in 2000 [Soros Foundation—Latvia 2001; Statistics Estonia 2016; Bureau central de statistique de l'Estonie 1937; Statistical Office of Estonia, Central Statistical Bureau of Latvia and Statistics Lithuania 2003].

plementation as a fundamental part of integrating Russian-language schools into the national school education systems of Latvia and Estonia. Integration is considered more or less successful if what society would like students to be taught (the intended curriculum) is approximately equal to what is actually taught in the classroom (the implemented curriculum) and what students actually learn (the attained curriculum).

The aim of this study was to determine whether integration has been achieved or at least whether the gaps among the three aspects of curriculum have reduced since the reformation of education content in Russian-language schools was initiated.

Data on the intended curriculum was obtained by examining the national curriculum regulations in both countries. Interviews with school teachers and principals provided information on the implemented curriculum. The attained curriculum was assessed using PISA results. An approach like this implies a mixed methods design, which combines qualitative and quantitative methods of data collection and analysis. Natural experiment methodology was applied to measure the effects of the new curriculum on educational outcomes.

Further on, the article scrutinizes the characteristics of education reform analysis methodology and describes the methodology and empirical basis of this study. Finally, research findings are presented and discussed using the lens of the threefold curriculum.

1. Methodology of the Three-Tier Approach to Curriculum Analysis

Since the intended, implemented, and attained curricula differ in their content, they cannot be assessed using the same method and require different analytical approaches.

The intended curriculum was analyzed using the official documents regulating the content and implementation of the new national school curriculum as part of the reform of Russian-language schools in Estonia and Latvia.

The implemented curriculum was assessed using interviews with school teachers and principals designed to measure the degree of curriculum integration and explore teachers' perceptions of the new curriculum. Because teachers and principals are mediators between the curriculum and students, they were selected to be respondents in the survey assessing the implemented curriculum. Studies show that if these key agents do not approve or accept a reform proposed, the latter will not be implemented to the extent originally planned [Erss et al. 2014; Spreen 2004; Livingstone et al.:7].

The attained curriculum was assessed by analyzing how PISA results of Latvian, Estonian, and Russian school students changed between 2006 and 2015, i. e. during the reform period.

Impossibility to measure precisely the role that specific reform interventions play in educational changes is a common problem experienced by researchers trying to assess reform effectiveness. Reforms

are introduced gradually, blurring the landscape of transformations, and the effects of reforms are hard to differentiate from those of other concurrent processes. This methodological problem is solved by the situation of natural experiment which had arisen from the historical events of the late 20th century. In the early 1990s, when the newly recognized states were building their own education systems, conditions under which initially similar groups existed began to come apart, as those groups were involved in different transformation processes. In a context like that, natural experiment provides an opportunity to compare the education systems of Latvia and Estonia to the precursor system (that of Russia).

Originally, the education systems of the three countries had very much in common, as Soviet authorities had worked hard to unify education standards across all the 15 republics—and finally achieved the goal by the end of the 1980s [Herbst, Wojciuk 2017; Mitter, 1992]. Teacher qualifications were also uniform across the three countries, a number of Latvian and Estonian teachers in Russian-language schools holding diplomas of Soviet colleges earned either in their home republic or in the Russian SFSR.

By the time the reforms were introduced—in the first half of the 2000s—the education systems of the countries analyzed had become extremely divergent, since the curricula and teaching practices of Latvia and Estonia had undergone considerable transformations, while those of Russia remained almost unchanged—in part due to the huge inertia of the national education system, in part due to lower reform intensity and lower acceptance rates among the teaching community [Borisenkov 2006; Kapuza et al. 2017].

In both Baltic countries, reformation of Russian-language schools began much later than that of majority-language schools. Some changes were introduced in ethnic majority schools as early as in the late 1980s and were in place throughout the 1990s. Meanwhile, Russian-language schools were kept in the background, maintaining their old curricula and teaching standards, and being largely disregarded and undermonitored by the educational authorities. It was not until the early 2000s in Latvia and the mid-2000s in Estonia that the reform of Russian-language schools was finally given impetus.

Comparative analysis of school students' academic achievements in Russia, Latvia and Estonia offers a rare opportunity to explore the educational outcomes (the attained curriculum) of Russian-speaking students attending schools in different countries—hence, studying in different learning contexts. Comparison of their academic achievements may help determine the role that learning environment plays in educational outcomes.

This study uses partially mixed concurrent equal status design to examine all the three manifestations of curriculum [Leech, Onwuegbuzie 2009]. This type of research design implies that quantitative and qualitative phases of research have purposes of their own, and the

combination of quantitative and qualitative findings allows conducting meta-inferences.

Document analysis was aimed at getting the idea of the new curriculum content and implementation process in Russian-language schools of Latvia and Estonia. The qualitative phase was focused on exploring the process of national school curriculum integration and acceptance in Russian-language schools of the two countries. This involved in-depth interviews with school principals and their deputies as well as classroom observations. Interviews included questions about school in general, teachers, national school curriculum and its transformations, teaching methods, approaches to student assessment and the reform-related changes in them, and participation in international student assessments, such as PISA and TIMSS. The interviewees were also asked to explain the improvement of PISA results in Russian-language schools. Classroom observations were designed to determine the teaching approaches used, identify manifestations of the new teaching practices, and measure overall classroom environment. Interviews were also conducted with Ministry of Education officials and reform designers.

The sample included seven schools in Estonia (Tallinn, Narva, and Kohtla-Järve), six in Latvia (Riga), and three in Russia (Moscow and Moscow Oblast). The schools were selected using the purposive and snowball sampling methods. One group interview and one classroom observation were conducted in each of the schools. The length of interviews varied between 90 and 120 minutes. Field studies were carried out in June and September 2013 in the Baltic states and in May–June 2013 and September 2014 in Russia.

Interview transcripts were explored using the method of thematic analysis, which consists in identifying patterns of meaning (themes) within data. Some preliminary codes were assigned to the themes outlined in the interview guides, and more codes were added in the process.

The quantitative phase involved comparing the changes in PISA results among majority-and Russian-language schools[2] in Latvia and Estonia and schools in Russia. Data from student questionnaires and PISA scores in reading, science and mathematics obtained in 2006,

[2] The language of school and home are not always the same. Estonian parents rarely send their children to Russian-language schools, and vice versa. Overall, in all the four cycles of PISA, only 4% of children speaking Russian at home attended Estonian-language schools, and 0.8% of those with Estonian as a home language attended Russian-language schools. As for Latvia, 8% of children with Russian as a home language attended Latvian-language schools, and 2% of children speaking Latvian at home attended Russian-language schools. Bearing in mind that ethnically diverse families are more than common for both countries, the study was not restricted to children speaking the same language at school and at home.

Table 1. **Sample Sizes for Each of the Five Groups Broken Down by PISA Years**

Number of students in	2006	2009	2012	2015
Russian-language schools in Latvia	1,515	1,034	1,064	1,282
Latvian-language schools in Latvia	3,177	3,457	3,230	3,567
Russian-language schools in Estonia	1,190	885	989	1,245
Estonian-language schools in Estonia	3,675	3,837	3,768	4,337
Russian schools	4,871	5,002	5,005	5,849
Total	14,428	14,215	14,056	16,280

2009, 2012, and 2015 are analyzed.[3] In both Baltic countries, PISA assessments were administered in the majority and Russian languages, Russian-language versions of questionnaires and tests being completely identical to those used in Russia. Access to this data allows not only comparing school students across the countries but also subcategories of students based on the language used in teaching. Table 1 shows the size of samples in each of the five groups broken down by years. The samples are representative for each country as well as for each language group within the countries.

PISA performance in the five groups was assessed using regression analysis, where PISA scores were a dependent variable and the type of school (based on the country and language used in teaching) was a predictor. In addition, the model featured a number of control variables, in particular socioeconomic status at the individual and group levels. Regression models were estimated for each assessment year.

$$S_{ij} = b_0 + b_1 St_i + b_2 Cnt_j + e_i,$$

where S_{ij} is standardized PISA score (in mathematics, science, or reading), St_i is socioeconomic status (mother's education, number of books in the home, average number of books among classmates),

[3] The PISA sample is representative for 15-year-old students in each of the countries. In Russia, 15-year-olds may attend a secondary or vocational school. The sample of Russian school students only included those attending secondary schools. Vocational schools excluded from analysis accounted for 14% of the sample in 2006, 5% in 2009, 4% in 2012, and 3% in 2015. The dramatic drop observed in 2009 is explained by the transition from three- to four-year programs in elementary education. As a result, beginning with 2009, 15-year-olds in Russia are normally enrolled in the 9th grade of secondary school, just as in the Baltic states. In Latvia and Estonia, less than 1% of 15-year-old students attend vocational schools.

and Cnt_j is a dummy variable for every group of schools depending on the language used in teaching.

2. Results

2.1. Education Reforms in Latvia and Estonia: The Intended Curriculum

Following the collapse of the Soviet Union, Latvia and Estonia initiated reforms of curricula, textbooks, and other instructional materials as well as teacher retraining campaigns in the majority-language schools [OECD2001a; Silova 2002b; Anweiler 1992; Mitter 1992]. In Estonia, some educational changes were introduced as early as in the late 1980s [OECD2001b]. Moreover, it was already in the 1960s and 1970s that this republic stood out with its eleven-year schooling (instead of ten-year programs), some curriculum variations in science, foreign languages, music and arts, and specialized high school curricula in nearly half of the schools.

Latvia's first education law was adopted in 1991 and revised in 1998. The new national school curriculum adopted in April 1998 placed special emphasis on knowledge application, problem-solving skills, and active learning. The regulations also stressed the role of Latvian as the language of national unity and the one to be used in teaching [Carnoy, Khavenson, Ivanova 2015; OECD2001a; Dedze, Catlaks 2001; Kangro, James 2008].

Estonia's first education law was adopted in 1992, followed by the 1998 law on secondary school education. The new national school curriculum was introduced in 1996 and revised in 2011. The teaching approaches contained in it are very similar to those in Latvia. In particular, the new Estonian curriculum advocates the idea of learning to learn, underlining the importance of fostering social competencies and encouraging initiative and entrepreneurial skills [Kitsing 2011; OECD2001b].

Curriculum reforms in Russian-language schools differed from those in the majority-language schools in both countries. In Estonia, such schools were left to themselves in the 1990s and even in the early 2000s, so no strict requirements applied to their curricula. In Latvia, the reformation of Russian-language schools started in 2000 and involved, most importantly, bilingual instruction since elementary school. The curriculum of Russian-language schools was modified to align with Latvia's national curriculum. Despite high-intensity teacher and principal retraining programs designed to meet the new standards and the broad public discussion of the bilingual education reform that preceded the introduction of the new school curriculum, the reformation process and the integration of new rules were distressing for Russian-language schools [Carnoy, Khavenson, Ivanova 2015; Dedze, Catlaks 2001; Silova 2002a; Khavenson, Carnoy 2016; Latvian Centre for Human Rights and Ethnic Studies 2004].

It was even later, in 2006–2007, that a comprehensive reform of the Russian-language school curriculum began in Estonia. Its goal was to integrate active and practice-oriented learning (not only ac-

quisition but also application of knowledge), functional reading, and other innovative teaching practices that had already been widely used by Estonian-language schools. Essential effort was applied to motivate school teachers and principals to participate in the reform process [Logvina 2014; OECD2001b]. Those changes can be regarded as the intended curriculum and at the same time as a signal to Russian-language schools in Latvia and Estonia about what children should learn.

2.2. The Schooling Process: The Implemented Curriculum

The results of interviews and observations were used to reconstruct the schooling processes, paying specific attention to the teaching methods and curriculum changes introduced by the reform.

2.2.1. The Learning Process and the Curriculum

Respondents in both Latvia and Estonia often mentioned some new practices and changes in the curriculum (Fig. 1) which emerged as a result of the reform, such as personalized learning ("*an individualized approach to every child instead of treating everyone in a uniform way*"), problem-based learning, focus on real-world connections, practical and experimental approaches and extracurricular activities in science education, knowledge application and logical reasoning tasks across the curriculum, functional reading across the curriculum (especially in Estonia), group work (projects, classroom teamwork), the use of new technologies (digital textbooks, interactive whiteboards, online resources, etc.), and the integration of PISA-based assessment instruments.

However, school teachers and principals' perceptions of such changes are divergent between Estonia and Latvia. Estonian project participants mostly give positive feedback on the new approaches to teaching and curriculum transformations, whereas Latvian principals and their deputies seem to have mixed feelings about the innovations. While recognizing the benefits of the new practices, they complain about the amount of time allocated to the integration of innovations: "*Experiments should not take up more than 20% of the school hours, but the proportion has already risen to 60%*". Still, they admit that students are more willing to engage in the learning process when classroom activities are organized using the new approaches.

The respondents in both countries feel positively about personalized learning as an educational trajectory as well as an everyday classroom practice. Judged by the interview data, teachers in both Estonia and Latvia devote very much attention to individual achievements of every child in a variety of disciplines, being prepared to deliver knowledge at different levels and evaluate performance within individual student progress profiles. Teachers' responses to interview questions often included such explanations as, "*It is a common practice when you divide the board in three—for three different groups*" or, "*Students take the same test but they may complete a different number of items.*" A unified approach to all students in the classroom is as-

Figure **1. The Curriculum Code and Its Sub-Codes.**

CURRICULUM

- Positive perception of the new curriculum (especially in Estonia)
- Knowledge application, experiments, real-world connections
- Knowledge construction, not reproduction
- Project activities
- Cross-curricular skills
- Functional reading
- PISA

Figure 2. **The Schooling Process Code and Its Sub-Codes.**

SCHOOLING PROCESS

- Extracurricular activities (trips, museums, factories, etc.), especially in science lessons
- Treating students in a friendly and respectful manner
- Personalized learning
- Group work
- Active learning
- Learning, not teaching
- IT

sociated with the Soviet era and is not supported by the teachers and administrators of Russian-language schools either.

A number of respondents in both Baltic states reported that changes in the curriculum and methods of its implementation were consistent with the PISA-format teaching strategies, meaning that school curricula had been developed drawing on the principles similar to those of the PISA assessment—hence, the test assessed the same skills that the new curriculum was designed to develop. As a result, Baltic school students' PISA scores in each of the subject areas (especially reading and science) improved.

Unlike in Estonia and Latvia, most teachers in Russia were still using the old teaching practices at the moment of the survey. The first national school curriculum based on a new, non-Soviet paradigm was proposed in 2009 and introduced in the first grade of elementary school in 2011. However, the respondents in Russia report little change in the teaching methods used even by retrained teachers since then. Besides, a major challenge was encountered by high school teachers. The new curriculum and the school-leaving examination in the form of the USE (Unified State Examination) pursued different goals, the former seeking to develop competencies and the latter, to test knowledge. Russian schools have not succeeded in personalizing their teaching practices. Most often, the respondents explain this failure by enormous teacher workloads: "*A teacher cannot make allowance for different student progress rates because it requires additional planning and differentiated assessment—but teacher workload is already too high.*" However, it follows naturally from the

interview data that teachers do not even bother trying to find personalized approaches to every student, not seeing it as key to the learning process (Fig. 2). What they mostly do is they build their teaching methods around the "average student". Therefore, the curriculum and teaching practices in Russian schools have changed very little in the post-Soviet period.

2.2.2. Advanced Teacher Training

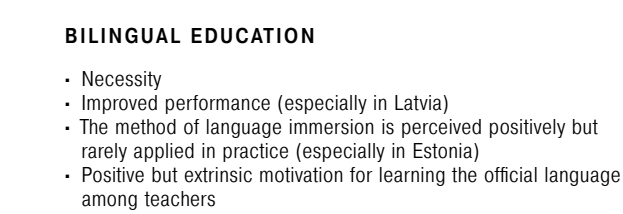
Major on-the-job training campaigns for school teachers and administrators were carried out in Estonia and Latvia. Among the courses they had taken over the recent years, the respondents mentioned the ones in which they had mastered new pedagogical practices that could be applied in teaching any discipline, such as personalized learning, classroom teamwork, project organization, real-world connections, new approaches to student assessment, and development of functional reading skills. The interviewees perceived such courses as useful and expressed interest in the relevant forms of professional development. In both countries, professional development courses were designed not only to provide teachers with new teaching methods and familiarize them with the curriculum changes but also to help them actually accept the new educational paradigm, the new system of values, and the new approaches. As one of the school principals said, "*Those courses have helped us shift away from the Soviet leadership model and do it our own, Estonian way; the overall thinking patterns concerning the school and students have changed*".

2.2.3. Bilingual Education

Bilingual education (Fig. 3) was one of the most debated and emotionally-charged issues in the interviews conducted in Latvian schools. The respondents were talking about advantages as well as pitfalls of such instruction. Bilingual education is considered the principal reform driver in Russian-language schools. Most school principals and teachers admit that it helps students succeed in adult life, but the integration process has been very tough for the schools. Teachers and administrators were most unhappy with the methods used to implement bilingual programs in the schooling practices. In addition, the interviewees were convinced that bilingual education had not promoted integration of the Latvian education system to the extent originally planned.

Nevertheless, bilingual education was referred to frequently when explaining the high PISA results of Russian-language schools. According to the school principals, learning two languages and switching between them during the school hours or even during a lesson promotes overall student development, which has led to achievements in a variety of domains, including the PISA. The principals of Russian-language schools were happy to see their students' PISA results improve. In 2012, Russian-language schools showed better performance in the PISA than Latvian-language ones, proving the effectiveness of bilingual instruction for school teachers and principals.

Figure 3. **The Bilingual Education Code and Its Sub-Codes.**



Along with bilingual education, a number of other initiatives were also taking place during the education reform period in the Baltic states, including teacher training courses on new student assessment methods, new teaching techniques, and latest instructional materials. It is highly probably that those initiatives played the determining role in the development of constructivist approaches to learning and promoted improvements in PISA performance.

In Estonia, bilingual instruction was originally regarded as a way to integrate students of Russian-language schools into the society. Bilingual programs are optional in elementary and middle school. The school principals rarely mentioned bilingual education when talking about student performance, but many of them expressed their positive attitude towards bilingual instruction practices, particularly language immersion activities; they had also noticed that more and more parents were willing to engage their children in such activities.

2.2.4. Examinations and the PISA

Student assessment principles and approaches often determine the teaching methods used [OECD2005; Erss, Kalmus, Autio 2016; Khavenson, Carnoy 2016]. In the Baltic states, final examinations take place at the end of the 9th and 12th grades. Many of the respondents see common features between those examinations and the PISA assessment: "*The exams do not copy the PISA, but they are based on the same principles*". Interviews with PISA coordinators in Latvia and Estonia also showed that the concepts of national school curriculum reform in those countries were in line with the OECD education objectives, which is largely reflected in PISA test questions. Participation in this international assessment, hence, is explained by the desire to see how well students have mastered the competencies measured by the PISA tests. In Russia, meanwhile, final examinations are focused much more on testing the level of knowledge, not competencies.

Latvian and Russian schools showed little interest in the PISA assessment, whereas schools in Estonia were motivated to participate. Given Estonia's serious approach to the PISA at a national scale [Khavenson, Carnoy 2016], greater involvement of schools in the project may entail better integration of Russian-language schools in Estonia than in Latvia.

Estonian school principals and their deputies often described the recent innovations in a positive or neutral way, feeling on the whole comfortable with the key reform principles. They showed a high level of readiness for trying out new practices and considered themselves active reform participants. The respondents in Latvia were more reserved in their evaluations of the reform and not too enthusiastic about the school transformations. While the Estonian interviewees often used the pronoun "*we*" (e.g. "*we are switching to...*", "*we are changing...*", "*we are trying...*") when discussing the educational change, their Latvian counterparts mostly used "*they*".

It follows from the interviews with officials of the Estonian Ministry of Education and Research that the Estonian government has put a great deal of effort to show school administrators and teachers that the changes proposed for Russian-language schools would promote integration and improve educational outcomes. The Ministry officials established personal contacts with schools, and it played a huge role. Russian-language school teachers and administrators emphasized that the government had engaged in a dialogue with them instead of imposing another bunch of requirements. Obviously, this governmental approach explains to a no small part the high degree of acceptance of the new educational paradigm among school teachers and administrators in Estonia.

The interview data indicates that components of the intended curriculum have been implemented in school education, and many of them have found manifestation in the teaching practices. Therefore, it can be inferred that the declared objectives of the curriculum reform are being achieved in classrooms.

2.3. Changes in PISA Performance: The Attained Curriculum

This study assumes that PISA results can be a good predictor of national curriculum attainment. Indeed, since the concept of PISA is largely consistent with the intended curricula of the Baltic countries, improvements in school students' PISA scores would imply a higher degree of curriculum attainment[4]. PISA performance in mathematics, reading and science was assessed in Russian- and majority-language schools. Regression equations (Table 2) were developed to test statistical significance of difference and control for the socioeconomic status at the individual and group levels.

2.3.1. Mathematics

Throughout the period of survey, Estonian-language schools performed better on the PISA mathematics literacy scale than Russian-language schools in both countries and Latvian-language

[4] We are not trying to establish a causal relationship to measure the contribution of specific curriculum aspects to PISA performance improvement. However, natural experiment methodology allows making less biased inferences than if traditional approaches to cross-sectional data analysis were used and hypothesizing on what exactly has worked.

Table 2. **PISA 2006–2015 Regression Analysis**

	Mathematics				Reading				Science			
	2006	2009	2012	2015	2006	2009	2012	2015	2006	2009	2012	2015
Type of School												
Russian-language schools in Latvia	–0.06 (0.07)	0.15** (0.07)	0.19*** (0.06)	–0.13** (0.06)	0.18*** (0.07)	0.22*** (0.06)	0.36*** (0.07)	0.03 (0.06)	–0.12** (0.06)	0.10 (0.07)	0.25*** (0.06)	0.15*** (0.06)
Latvian-language schools in Latvia	0.00 (0.05)	0.23*** (0.05)	0.16*** (0.05)	–0.11** (0.05)	0.30*** (0.05)	0.32*** (0.04)	0.21*** (0.05)	–0.09* (0.05)	0.01 (0.05)	0.26*** (0.05)	0.28*** (0.05)	0.05 (0.05)
Russian-language schools in Estonia	–0.11 (0.07)	0.11 (0.08)	0.18*** (0.07)	0.07 (0.07)	–0.15** (0.07)	0.12* (0.07)	0.16** (0.06)	0.02 (0.07)	–0.04 (0.07)	0.18*** (0.07)	0.34*** (0.07)	0.20*** (0.07)
Estonian-language schools in Estonia	0.34*** (0.05)	0.49*** (0.06)	0.44*** (0.05)	0.32*** (0.06)	0.58*** (0.05)	0.38*** (0.05)	0.43*** (0.05)	0.26*** (0.05)	0.48*** (0.04)	0.55*** (0.06)	0.63*** (0.05)	0.59*** (0.05)
Control variables (socioeconomic status):												
26–100 books in the home	0.30*** (0.05)	0.24*** (0.03)	0.36*** (0.04)	0.31*** (0.05)	0.34*** (0.05)	0.31*** (0.04)	0.29*** (0.03)	0.44*** (0.04)	0.33*** (0.05)	0.27*** (0.04)	0.39*** (0.04)	0.42*** (0.03)
Over 100 books in the home	0.58*** (0.05)	0.47*** (0.04)	0.57*** (0.05)	0.49*** (0.06)	0.53*** (0.06)	0.53*** (0.04)	0.50*** (0.04)	0.56*** (0.05)	0.54*** (0.06)	0.53*** (0.04)	0.59*** (0.04)	0.62*** (0.05)
Mother's education (high school)	–0.28** (0.14)	–0.12 (0.09)	–0.30*** (0.11)	–0.28** (0.11)	–0.27** (0.11)	–0.22** (0.11)	–0.24** (0.11)	–0.16 (0.11)	–0.26** (0.10)	–0.16 (0.11)	–0.24** (0.10)	–0.16 (0.10)
Mother's education (college degree)	0.15*** (0.04)	0.25*** (0.05)	0.20*** (0.06)	0.15** (0.06)	0.11*** (0.04)	0.22*** (0.04)	0.28*** (0.05)	0.16** (0.07)	0.13*** (0.04)	0.24*** (0.05)	0.26*** (0.05)	0.17*** (0.06)
Average number of books among classmates	0.19*** (0.03)	0.23*** (0.04)	0.20*** (0.04)	0.11*** (0.03)	0.24*** (0.04)	0.26*** (0.04)	0.30*** (0.04)	0.17*** (0.03)	0.21*** (0.03)	0.21*** (0.04)	0.23*** (0.03)	0.17*** (0.03)
Constant	–0.35*** (0.05)	–0.51*** (0.06)	–0.34*** (0.07)	–0.35*** (0.08)	–0.54*** (0.06)	–0.41*** (0.05)	–0.21*** (0.06)	–0.43*** (0.07)	–0.38*** (0.05)	–0.48*** (0.06)	–0.42*** (0.06)	–0.45*** (0.07)
R^2	0.13	0.15	0.14	0.07	0.16	0.18	0.19	0.11	0.14	0.13	0.18	0.11
Number of observations	14,227	13,881	13,655	15,798	14,227	13,881	13,655	15,798	14,227	13,881	13,655	15,798

*** p<0.01, ** p<0.05, * p<0.1
Robust standard errors in parentheses.
Control group: students in Russian schools; 0–25 books in the home, vocational education.

schools. As of 2006, performance in the latter three groups (Russian-language schools in Estonia, Russian-language schools in Latvia, and Latvian-language schools in Latvia) was nearly the same as in Russia. The students of Russian-language schools in Latvia who participated in the PISA in 2006 had started school in 1997–1998, when the reform had not yet been introduced. The next cohort—participants of the PISA 2009—had been attending school when the curriculum was changed. It can be seen from Table 2 that students of Russian-language schools in Latvia improved their performance in 2009 and outdid their counterparts in Russia in 2012.

A considerable improvement in mathematical literacy is observed between 2009 and 2012 in Estonia. Estonia initiated the reforms just after the PISA 2006, but improving the performance in mathematics that fast was a challenging task (as compared to the other subject areas), to some extent because mathematics had always been a strong component of Soviet education and teachers were reluctant to abandon the teaching methods that had been successful in the old paradigm in favor of the new curriculum. It was only by 2012 that step-by-step integration of tasks in applied mathematics had yielded an essential improvement in PISA scores.

2.3.2. Reading

Reading literacy performance of Estonian- and Latvian-language schools was statistically significantly higher than that of Russian schools during the whole period of survey. The gap kept growing until 2012. Changes in PISA performance of Russian-language schools were more in line with the reform process in Estonia than in Latvia. Consequently, they might be related to the curriculum transformations. Consistent and active implementation of functional reading in Estonia may have been the driver of the prominent improvement in reading literacy between 2006 and 2012.

2.3.3. Science

As with mathematics and reading, science literacy scores in all the language groups were higher in the Baltic states than in Russia in 2012, even though performance of Russian-language schools in Estonia and Latvia had been equal to or worse than that of Russian schools in 2006, at the very start of the survey. The year 2006 saw the first changes to the science curriculum of Russian-language schools in Estonia. Performance of those schools had enhanced by 2009 and continued improving until 2012. Latvia, on the other hand, introduced the new national school curriculum gradually, so it was not until 2012 that achieving high scores became possible.

By 2012, as a result, Russian-language schools in Estonia and Latvia had performed statistically significantly better in the PISA than schools in Russia, where the curriculum remained the same as in the Baltic states before the reform and had changed very little by then. The high PISA scores of Baltic school students and the upward trends

during the survey period indicate the gap between the intended and attained curricula in Latvia and Estonia being reduced.

Changes that had taken place by 2015 deserve special attention. On the one hand, PISA 2015 outcomes are rather distant in time from the reforms implemented, so their analysis is challenging within the framework of natural experiment methodology. By that time, all the countries had been introducing innovations not only as part of the curriculum reform but also under other initiatives. With regard to reform impact analysis, such concurrent innovations add noise to the inferences, making it impossible to compare changes in the attained curriculum to those in the intended and implemented curricula accurately enough. On the other hand, analysis of the 2015 PISA results may reveal long-term effects of the reforms, even if corrected for other possible factors.

Due to a variety of reasons, including curriculum changes, performance of Russian students in PISA reading and mathematical literacy had improved considerably by 2015 [Kapuza et al. 2017], being slightly higher than in both types of schools in Latvia, where the reform effects on PISA performance were apparently weaker and less consistent. Without outside pressure, Russian-language schools, which had not welcomed the new teaching approaches, could return to the old practices that they were used to. Estonian-language schools which had adopted a PISA-aligned curriculum long ago showed a consistently high level of performance in the 2015 assessment. No statistically significant difference is observed in the PISA scores in mathematics and reading between schools in Russia and Russian-language schools in Estonia. In addition to the decline of reform effects and the improvement in Russian students' PISA outcomes, other factors unrelated to the language used in teaching had become more powerful [Poder, Lauri, Rahnu 2017].

The dynamic of PISA results in science differs from that in reading and mathematics, Russian-language schools in both Baltic states remaining at a statistically significantly higher level of performance than schools in Russia in 2015. As the interview data indicates, both the science curriculum and teaching process were revised to a greater extent and accepted more readily by teachers, which led to more coherence between the implemented and intended curriculum as well as between the attained and implemented curriculum.

3. Conclusion and Discussion

Integration of ethnic minority groups became one of the problems faced by the education systems of the countries that emerged from the collapse of the Soviet Union. The Baltic states implemented some impressive education reforms, repudiating their Soviet past. The first wave of reforms was launched in the early 1990s. In both Estonia and Latvia, the reforms of the 1990s were targeted to majority-language schools, while Russian-languages schools joined the process later.

The reforms were seeking, in particular, to eliminate the divergences in curriculum between the schools using different languages in teaching. There is an opinion that this initiative promoted integration of the ethnic minority group into the national community—or at least it had this purpose. In order to find out whether the new curriculum was accepted by Russian-language schools, we analyzed the process of curriculum implementation and assessed the changes in student performance throughout the whole reform period.

Indeed, divergences between the intended, implemented and attained curriculum are being reduced. The intended curriculum, stipulated in the official regulations, is clearly observed in the learning process in Russian-language schools. The schools actively use the new teaching approaches, such as expanding the range of tasks designed to develop knowledge application and critical thinking competencies, functional reading activities, active learning, extracurricular activities, and, in particular, personalized learning and respect for students as the foundations of teaching policy. PISA performance of Russian-language schools was growing steadily during the whole period of survey, which indicates that the gap between the intended and attained curriculum is closing. It remains unclear, however, how long the reform effects will last. The 2015 PISA results show that the relative improvement of PISA scores in Russian-language schools has slowed down. The reasons may include, first of all, the reduced performance gap between Russian and Baltic schools as a result of the Russian curriculum reform and, second, subsequent reforms in the Baltic states that weakened the visible effects of the earlier innovations.

The interview data shows that school principals and teachers in Estonia perceived the reforms more positively than those in Latvia, showing a higher degree of recognition and acceptance. The reform procedures differed between Estonia and Latvia. Innovations in Estonia were introduced extensively and thus took less time. They were mostly designed to introduce specific teaching approaches and new curriculum practices. Estonian education authorities devoted more time and effort to bringing school administrators and teachers on their side. In Latvia, the first innovations met more resistance than in Estonia. School teachers and principals did not feel deeply involved in the reform process even if they sympathized the new approaches in general. Therefore, this study also demonstrates that healthy emotional environment makes the implementation of reform-related changes easier and more effective.

The quality and intensity of education reforms depend largely on whether the innovations are accepted by the parties involved. Nevertheless, this obvious step is often ignored by reform planners. Explaining the purposes, ensuring comprehensive professional training and development, and engaging all the parties in discussion and implementation may facilitate the acceptance and integration of innovations, ultimately saving resources in the broad sense of the word.

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