

RESEARCH

Does First-Language Training Matter for Immigrant Children's School Achievements? Evidence from a Danish School Reform

Anna Tegunimataka^{1,2}¹ Department of Economic History, Lund University, Lund, SE² Centre for Economic Demography, Lund University, Lund, SEanna.tegunimataka@ekh.lu.se

This article explores municipal variation in the implementation of a Danish educational reform. The aim of the reform was to increase the assimilation of immigrants, and removing mother-tongue training for first- and second-generation immigrants was believed to increase their proficiency in Danish. This article uses a difference-in-differences method to explore the effect of this removal on children's educational outcomes in terms of grades in standardised tests in class nine, assessing both grades in the majority language Danish and grades in mathematics. This study, furthermore, takes potential heterogeneities in terms of gender and immigrant generation into consideration. This study shows that the expected results of the reform were not obtained. Rather the opposite that the removal of mother-tongue training leads to lower grades in Danish for boys and in mathematics for both boys and girls.

Keywords: Immigrant integration; Second-language acquisition; School reform; School achievements

Introduction

Immigrant children fall behind their native peers in terms of educational attainment in many Western European countries. Policies with the aim of closing this immigrant-native educational gap are often implemented, however, more rarely evaluated (Paola & Brunello 2016). One such measure is first-language training for immigrant children that has been a source of much debate among policymakers in the Nordic countries. Advocates of this education argue that mother-tongue proficiency contributes to immigrant children's academic achievements in general and that it helps with learning the host-country language in particular. Opponents have instead emphasised the importance of focusing on the host-country language in schools and that teaching should be conducted in this language only.

There is very limited quantitative evidence on the effects of mother-tongue training for host-country language proficiency in Europe (Mehlbye et al. 2011; Relji, Ferring & Martin 2015). Expanding the research on mother-tongue acquisition in a majority language context is important because an increasing number of children grow up in a second-language setting

as a result of increasing migration. More knowledge on the effects of different integration measures in schools could help policymakers with designing successful reforms to increase educational attainment among students with an immigrant background and subsequently enhance immigrant integration.

The development in Denmark offers excellent opportunities to shed further light on this issue. Until 2002, supplementary mother-tongue education had been offered to all children with at least one parent with a different mother tongue than Danish if this language was spoken daily. After that year, state-financed support for supplementary mother-tongue education was removed for students from non-European countries. Municipalities could, however, decide to keep mother-tongue education for children from other countries if financing it themselves. This policy decision led to a situation of mother-tongue training being dependent on the municipality of residence.

The main objective of this article is to study the effects of removing supplementary mother-tongue training for first- and second-generation immigrants in primary schools. This article uses a difference-in-difference framework to explore the effect of this removal on children's educational outcomes in terms of grades in standardised tests in class nine, assessing both grades in the majority language Danish and grades in mathematics. This study, furthermore, takes potential heterogeneities in terms of gender and immigrant generation into consideration.

What Matters for Second-Language Acquisition?

For foreign-born individuals, the mother tongue (or first language, L1)¹ is often different from the majority language of the county in which they live, and to fully integrate into the receiving country, achieving a certain proficiency in the majority language (L2) is of vital importance (Dustmann & Fabbri 2003).

In studies of foreign-born's language acquisition, age of arrival is often regarded as crucial in determining the success of second-language proficiency. According to the 'critical period hypothesis', there is a biologically determined period of life (often defined as before puberty) when language can be acquired more easily and when native competence is obtainable (Singleton & Lengyel 1995; Snow & Hoefhagel-Höhle 1978). Beyond this time, language is more difficult to acquire. Immigrants who arrive in early childhood will acquire the second language more easily than late arrivals. Length of exposure to the second language is another factor that has been brought forward as important for successful second-language acquisition (Hyltenstam 2007; Krashen 1982). It simply means that learning a second language takes time and that the more years spent in a second-language context, the more likely the second language acquisition is to be successful. This study includes both first- and second-generation immigrants, and according to this theory they should have different outcomes in terms of second-language acquisition. Second-generation immigrants are, by definition, born in Denmark, and they have been exposed to Danish their entire life, whereas all first-generation immigrants have been born in other countries.

Another individual-level factor that matters for successful second-language acquisition is gender. There is clear evidence of females performing better than males in L1, both in writing and oral communication (Cole 1997; Lietz 2006). The gender gap in language acquisition is, moreover, found in many different countries (see Lietz (2006) for a metastudy). Although less

¹ L1 is the first language an individual is exposed to (the mother tongue) and L2 is any other language that follows. An individual is not necessarily more proficient in the first language, and for immigrants it is not uncommon that the individual will, in time, gain better proficiency in the second language if this language is the majority language (Hyltenstam, 2007).

studied, research has also found substantial gender differences in second-language acquisition (see, e.g. Davies 2004; Boyle 1987), with females outperforming males. The literature provides a number of explanations to the observed gender differences in language acquisition. There is some evidence that this is because of differences in hormonal configurations creating differences in cognition (Kimura 1999), whereas others explain the gender differences as being a social construct related to upbringing (Saville-Troike 2005). There is, furthermore, some evidence that immigrant girls in a second-language context perform better than boys, in terms of the mother tongue (Portes & Hao 1998; Schmid 2001). This has been explained by a higher tendency of mother-tongue maintenance among girls and girls being more likely to have the role of translators within the extended family, which would give them more practice in the mother tongue at home than boys (Tannenbaum & Berkovich 2005; Schmid 2001); this could be interpreted as them needing less mother-tongue training than boys at school. They would, in other words, achieve a higher proficiency in their mother tongue – important for second-language acquisition – at home, and thus have less need for additional training in schools. Gender differences are furthermore found in mathematics, but here boys tend to outperform girls (Benbow & Stanley 1980; Stoet & Geary 2013). The explanations for the gender division in mathematics are beyond the scope of this study; however, reasons such as lower confidence of girls and upbringing have been brought forward in previous research (see, for example, Spence, Steele & Quinn 1999).

Parental socio-economic status (SES) is another factor that is closely related to children's educational success and attainment (Sirin, 2005; White 1982) as children of parents with higher education tend to do better in schools than children of parents with lower education. The pace and success of acquiring a second language is, not surprisingly, also related to parental SES. There are a number of ways in which SES affects language acquisition. Low SES is related to a higher likelihood of premature births, poor nutrition during pregnancy and higher levels of stress that will affect early development of the child and subsequently affect the child's cognitive ability and possibilities of acquiring a second language (Noble et al. 2006; Thomas, Forrester & Ronald 2013). Low SES is furthermore related to parental resources in terms of communication skills and help with homework, and also basic access to items that directly affect language development, such as books, computers, newspapers, and so on. Moreover, parental values and attitudes towards education as well as their experiences are linked to children's second-language acquisition (Hyltenstam 2007).

Mother-tongue education can be seen as an important tool for minority children to gain or maintain proficiency in their mother tongue, to uphold a cultural and social link to the country of origin and to promote socialisation within the extended family (Hyltenstam 2007). The actual link between mother tongue and the majority language has, however, been heavily debated among scholars. Roughly two different standpoints are found in the literature (see Ball 2010), where the first view regards the learning of L2 as independent from learning L1. The 'separate development hypothesis' proposes that the same cognitive skills enable the learning of both languages, where learning L2 is neither helped nor hindered by the learning of L1 (Miesel 1994). In other words, individual languages develop distinctly from other languages. This would mean (in a simplified way) that learning Danish is independent of mother-tongue proficiency and that Danish can be developed and acquired successfully without any particular knowledge of the mother tongue.

In contrast to this view is the 'threshold-level hypothesis', which proposes that reaching a threshold of competence in the first language facilitates the learning of a second language to the full extent (Skutnabb-Kangas 1984; Cummins 1991, 2013). Knowing two languages (bilingualism) is, according to this theory, related to a greater cognitive and problem-solving ability (Clarkson 2007) that is beneficial for general academic achievement. An early influential

study conducted in the late 1970s studied Finnish-speaking immigrant children in Sweden (Skutnabb-Kangas and Toukomaa 1976). The main conclusion of the study was that children who did not have sufficient training and proficiency in their first language would have a weaker performance in schools and a lower competence in their second language. Cummins (1984) argues that high-level proficiency means more than basic communication in everyday situations and rather something referred to as 'cognitive academic language proficiency' (CALP) that includes extensive language knowledge and writing skills and that more cognitively demanding tasks, such as content learning and abstract thinking, are common across languages. Achieving a certain level of proficiency in one language will facilitate achieving the same level in another language (Francis, Lesaux & August 2006). According to this theory, it is important for learners to achieve CALP in their first language/mother tongue because this competence can be easily transferred to the second language. A link between high proficiency in two languages and mathematics is furthermore suggested. The argument is that high-level language proficiency increases an individual's general problem-solving ability, which is beneficial for achievements in mathematics (Barwell, Barton & Mamokgethi 2007). Hill (1995) conducted detailed interviews with 42 high-school students in Sweden and found a positive association between grades in the majority language and in mathematics, and partaking in the mother-tongue education provided in the schools. Thomas and Collier (1997) showed a positive association between mother-tongue education and majority language proficiency. Controlling for socio-economic differences, they suggested that children receiving supplementary mother-tongue education in parallel with majority language education performed better than students who only received education in the majority language.²

To our knowledge there is only one study using Danish data. Mehlbye et al. (2011) used PISA data and found a positive association between participation in mother-tongue education and grades in Danish. The study however used cross-sectional data and a method of analysis that did not cancel out selection.

A number of meta-studies on the effectiveness of bilingual education have been conducted in the United States, and the main conclusion is that bilingual education in general has a small but positive effect on achievement in English as a majority language (see, e.g. Rolstad et al. 2005; Willig 1985; and more recently Relji, Ferring & Martin, 2015, for a summary of previous meta-studies). In a European context, very few studies have been conducted and there is a large variation in terms of samples, methods and outcomes measured. In their meta-study, Relji et al. (2015) concluded that, although limited in number, European studies suggest overall results very similar to the American ones – that bilingual education for minority students has a positive but small effect on educational outcomes.

Hypotheses

Based on the discussions on theory and research previously mentioned, five hypotheses are formulated.

Hypothesis 1: First-language education is important for second-language achievement, and, thus, the removal of mother-tongue education would lead to negative effects on grades in Danish for immigrants with a different L1 than Danish.

Hypothesis 2: First-language education is important for the general problem-solving ability; therefore, the removal of mother-tongue education would lead to a negative association with grades in mathematics for immigrants with a different L1 than Danish.

² The studies by Thomas and Collier were, however, heavily criticised by Rossell (1998) for misinterpreting the results.

Hypothesis 3: The removal of mother-tongue education will affect boys and girls in different ways because of gender differences in second-language acquisition and mother-tongue proficiency. Girls have more mother-tongue training within the household which, according to the theoretical discussion, leads to better second-language performance. The removal of supplementary mother-tongue training would thus affect them to a lesser extent than boys.

Hypothesis 4: The removal of mother-tongue education will affect first- and second-generation immigrants differently because of differences in majority language exposure. The second generation has had longer exposure to the language and the removal of supplementary mother-tongue education will matter less to them than to those foreign born.

Hypothesis 5: The removal of mother-tongue education will affect socio-economic groups differently and those with a lower socio-economic background will be more negatively affected by the reform.

Method

This article studies the effect of removing mother-tongue education for first- and second-generation immigrants on grades in Danish and mathematics using a difference-in-difference identification strategy, which compares grades of students in municipalities that removed this form of education (treated) with grades of students in municipalities that kept it (untreated). The main advantage of this empirical strategy is that it makes use of the variation in the implementation of the reform: Some municipalities decided to remove this form of education when financial support from the state was lost, whereas other municipalities kept it.

The reform was implemented in the autumn semester of 2002. Children born in 1995 started school in 2002 and thus they were not offered mother-tongue education in primary school in municipalities that had decided to remove this form of education. All cohorts starting school after the implementation were not offered any mother-tongue education (in the municipalities that removed it). Children born in 1994 starting school in 2001 had one year of mother-tongue education in municipalities that removed it and children starting school in 2000 had two years, and so on. **Figure 1** shows the different cohorts and the number of years of exposure to mother-tongue education in treated municipalities (municipalities removing mother-tongue education).

The following equation shows the difference-in-difference estimator of this study:

$$D_i D = (Y_{T,post} - Y_{T,pre}) - (Y_{C,post} - Y_{C,pre}) \quad (1)$$

$Y(T)$ is the standardised grade outcomes of children in the municipalities that decided to keep mother-tongue training (untreated) and $Y(C)$ is the standardised grade outcomes of children in municipalities that removed mother-tongue training (untreated), comparing the grades of children before (pre) and after (post) implementation of the reform. To measure the effect of mother-tongue training on grade outcomes, the following regression model is estimated:

$$Y_{it} = \alpha + \beta_{treated} + \beta_{after} + \delta(treated * after)_{it} + \beta_{trend} + \beta_{municipality} + \beta X_i + \varepsilon_i \quad (2)$$

Y_{it} denotes the grade performance of children taking the exam in year t . *Treated* and *after* are two dummy variables; *treated* taking the value of 1 if the student lived in a municipality that decided to remove mother-tongue education, and the value of 0 if the municipality kept mother-tongue training. *After* takes the value of 1 if the student attended primary school after the reform was implemented and the value of 0 if the student attended primary school before the reform.

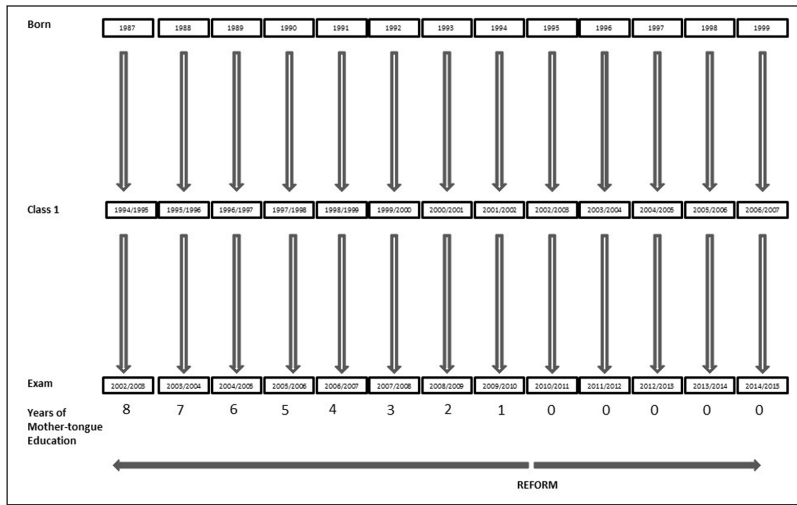


Figure 1: Cohorts included in the study, years of exposure to mother-tongue education in treated municipalities (removing mother-tongue education).

Treatment is not completely randomly assigned because municipalities had the right to decide if they wanted to keep providing mother-tongue training or remove it. Therefore, it is likely that the reform exposure is correlated with other municipality-specific characteristics, such as immigrant composition, or school results. Municipality dummies are therefore included in the analysis to control for all municipality characteristics that are time-constant. However, the municipality dummies do not take account of characteristics at the municipality level that change over time. In order for the identification strategy to hold, we assume that the average change in the comparison group represents the counterfactual change in the treatment group (without any treatment). This assumption is commonly referred to as the *parallel trend assumption*. That means that the outcome variable of interest would have been the same in treatment and control municipalities if there had been no policy intervention. This assumption is sensitive to differences in pre-implementation trends and thus municipality-specific time trends are included in all models. *Trend* is a municipality-specific linear trend and *municipality* is a municipality dummy. The δ is the main parameter of interest as it captures the difference in grade outcomes between the children who had mother-tongue education and the children who did not have mother-tongue education in school. X is a vector of other covariates such as parental age, parental education and number of children in family (see full list of covariates in **Table 3**).

The analysis is separated according to gender, immigrant generation and parental education, and effects on grades in both Danish and mathematics are assessed. Studying differences between first- and second-generation immigrants is important because second-generation immigrants are by definition born in Denmark and have thus been exposed to Danish their entire life.³ Three sensitivity analyses are furthermore included. First, potential bias from a municipality reform that took place in Denmark in 2007 is taken into consideration, and, second, a placebo analysis is performed where the removal of mother-tongue education is studied for first- and second-generation immigrants from the EU and EES. As the reform did not matter for these students, no effects should be found for them. Finally, a second placebo approach, changing the year of the reform, is conducted.

³ We are not controlling for YSM (years since migration) as this only applies to the first-generation immigrants.

Data

Register data

The analysis is based on Danish administrative records, linking different registers using a personal identifier together with survey data containing information on whether municipalities kept mother-tongue education. The register data includes individual-level demographic information; for example, age, gender, parental age, country of origin and municipality of residence, as well as socio-economic characteristics such as parental education and parental labour-market attachment. The main outcome variables are grades from centralised final examinations in the school subjects of Danish language and mathematics in class nine. This study assesses both subjects because they are indications of different skills and because mother-tongue proficiency has theoretically been linked to attainment in both the second language and mathematics (see section on theory and previous research). The exams are identical for all schools in Denmark and thus considered comparable (Nielsen & Rangvid 2012). They are furthermore marked both by the class teacher and by an external examiner who has the dominant opinion of the final grade. The current Danish grading system is based on the '7-point scale', which was changed during the academic year of 2005/2006 from the '13-point scale'.⁴ To ease the comparison, grades are standardised to have a mean of zero and a standard deviation of one within each school year. In both subjects, several exams have been conducted (such as spelling and reading comprehension in Danish), and the outcome variable therefore represents the grade average of several exams.

Survey data

Survey data is linked to the register data to add information concerning whether a municipality kept mother-tongue training or removed it after the policy change. The survey was conducted during the academic year of 2007/2008 with the aim of mapping out the existence of mother-tongue education in Denmark after the reform implementation in 2002/2003. All Danish municipalities were asked whether they offered supplementary mother-tongue training to students from countries other than those in the EU, EES, Greenland and the Faroe Islands during the academic year of 2007/2008 (see Timm (2009) for more details). Although the survey data provide information vital for this study, they have a few shortcomings. There is no information with regard to the availability of mother-tongue education for the years between the academic years of 2002/2003 and 2007/2008 when the survey data were collected. The analysis thus relies on the assumption that no changes occurred between these two points in time. An additional survey was, however, conducted in December 2016 to see if any municipalities had changed their decision with regard to the mother tongue since the initial survey. Out of 13 municipalities that provided this form of education in 2007/2008, five did not provide it when asked in December 2016. These five municipalities have been dropped from the analysis. This might seem a bit much but is not considered a major problem because the five municipalities that did not continue mother-tongue education have a rather limited foreign-born population and they comprise around 6% of the students with an immigrant background in the municipalities that provided mother-tongue training in 2007/2008. All municipalities that did not provide mother-tongue education according to the initial survey during 2007/2008 were also asked if they had changed their decision with regard to the provision of mother-tongue education. None of the municipalities that did not provide mother-tongue education in 2007/2008 offered it in 2016. This means that the data used in the analysis include 70 treated and 8 untreated municipalities. Twenty out of

⁴ The 13-point scale and the 7-point scale are the official Danish names of the two grading systems. The first name is based on the highest grade points achieved and the second is based on the number of different grades given.

Denmark's 98 municipalities have been dropped from the analysis, mainly because of not responding in the first survey (see Table A, appendix).

The map in **Figure 2** shows the municipalities that have kept (untreated) and those that have removed (treated) mother-tongue training.

The mother-tongue education that was available in all municipalities until the implementation of the reform at the start of the autumn semester of 2002 normally took place after school and for about 3–5 hours a week. The municipalities that decided to keep supplementary mother-tongue training for all students of immigrant background kept the same format.⁵

Sample

To qualify for mother-tongue training, the student needs to have at least one parent with a mother tongue other than Danish, which must be the language spoken at home on a daily basis. The registers do not contain information on the language spoken in the household; however, they contain information with regard to the country of birth of the parents. Children with intermarried parents (one parent being a native Dane with native-born parents) are excluded, as these children are more likely to speak Danish at home on a daily basis. Native Danish children with two Danish-born parents are furthermore not included in the analysis. That means that the sample used in the main analysis includes all the first- and

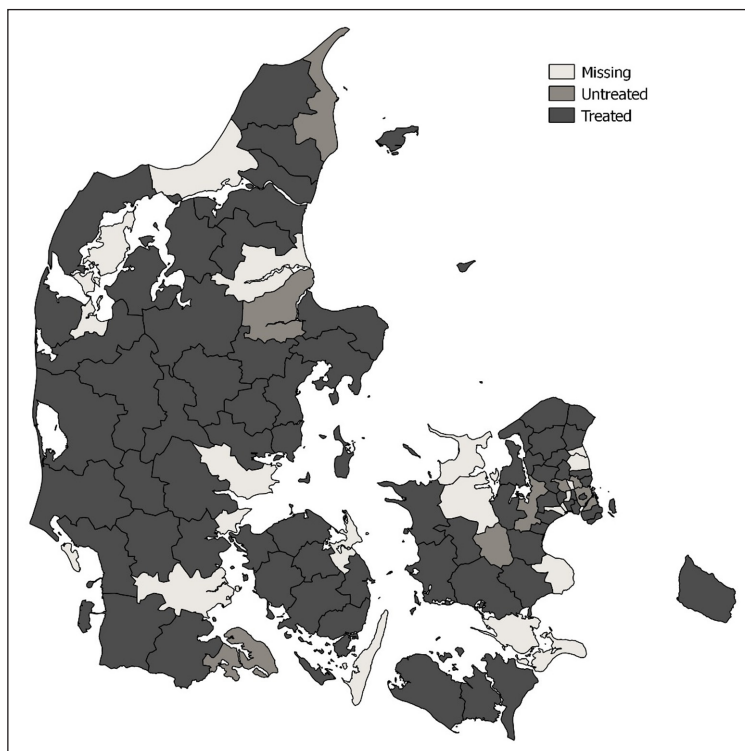


Figure 2: Map of Danish municipalities: treated and untreated Map downloaded with permission from the Danish Geodata Agency.

⁵ A limitation to this study is that there is no data on the individual uptake of mother-tongue training. We only know which municipalities offered students this training but not the actual uptake.

second-generation immigrants with two parents born in countries that are not part of the EU, EES, Greenland and the Faroe Islands.⁶

To avoid including individuals from families that move between treated and untreated municipalities, because of the removal of mother-tongue education, individuals that move in short connection with the implementation (between 2002 and 2005) of the reform are excluded (about 2.32% of the original sample).

The main analysis is conducted by analysing grades based on test scores for Danish using a pooled sample of 22,471 students who live in the municipalities that kept mother-tongue education and 34,045 students in municipalities that removed it.⁷ The children included were born between 1987 and 1999 and started school between the academic year of 1994/1995 and 2006/2007, taking their final exams in Danish and mathematics between 2002/2003 and 2014/2015. The full sample consists of 71% second-generation immigrants and 29% first-generation immigrants. Sixty-three percent of all first-generation immigrants originate from Asia (with Pakistan and Turkey being the dominant countries of origin). Asia is also the dominant region of origin for the parents of the second generation. To account for the socio-economic position of the family, parental education is denoted as the highest education obtained for parents at the time of the child's examination. The variable has four categories: (1) unknown education, (2) primary education, (3) secondary education and (4) tertiary education.⁸ Parental labour-market attachment is another socio-economic indicator that is taken into account in the analysis. The variable is a dummy variable: (0) unemployed and (1) employed or self-employed⁹ (at time of exam). The models have also control for parental separation and number of children in family.

Tables 1 and 2 present variable means for treated and untreated municipalities. The variable means in the two tables are roughly similar. One visible difference is a slightly higher paternal age for children in untreated municipalities. Parental separation is also more common in untreated municipalities and the number of children in the family is slightly higher in treated municipalities. The differences found between treated and untreated municipalities is not regarded as a problem; in accordance with the parallel trend assumption, it does not require levels to be the same; only that trends are the same in the municipalities included. Controls for trends are consequently included in the models.

Results

Figure 3 displays descriptive patterns in the data by showing differences in grades in Danish and mathematics for boys and girls, comparing treated and untreated municipalities (grades are not standardised and no controls are added). The general pattern demonstrates gender differences in both subjects. Girls perform better than boys in both treated and untreated municipalities in Danish, whereas boys outperform girls slightly in mathematics. There is also a general drift towards higher grades over time, especially in the case of Danish. This general drift in Danish grades has been noted by the Danish Ministry of Education (2015) and can possibly be explained by the introduction of a new grading system in 2007. Comparing

⁶ Children from the EU, the EES, Greenland and the Faroe Islands are included in the placebo analysis (Tables 7 and 8).

⁷ For mathematics, the sample is somewhat smaller and includes in total 56,054 individuals.

⁸ There are a few parents in the data set with unknown education and certain values were imputed, and in order to check the stability of the data, a sensitivity analysis was conducted excluding all individuals with imputed or missing parental education. Results did not change.

⁹ The variable is created using the Employment Classification Module (Arbejdsklassifikationsmodul AKM), which is based on a range of information about personal income, education, industry of employment, unemployment insurance information, and reports from private companies, assigning individuals their labor market status.

Table 1: Variable means by gender and immigrant generation of treated municipalities (removing mother-tongue training).

Year	2009.3	2009.3	2009.4	2008.3	2009.9	2008.3	2008.3	2009.9	2008.3	2009.9	2009.8
All	Boys	Girls	First-generation immigrants	Second-generation immigrants	Male first-generation immigrants	Female first-generation immigrants	Male second-generation immigrants	Female second-generation immigrants			
Father's age	47.6	47.6	47.6	47.8	47.4	47.7	47.9	47.5	47.4	47.4	47.4
Mother's age	43.1	43.1	43.1	43.0	43.1	43.0	43.0	43.2	43.1	43.1	43.1
Father's education											
Unknown	10.1	10.2	10.02	9.33	10.49	9.42	9.23	10.59	10.39	10.39	10.39
Primary	28.9	28.7	29.2	23.78	31.47	23.76	23.79	31.14	31.78	31.78	31.78
Secondary	35.8	35.8	35.71	35.53	35.88	35.16	35.91	36.16	35.62	35.62	35.62
Tertiary	25.2	25.3	25.06	31.37	22.16	31.65	31.07	22.11	22.2	22.2	22.2
Mother's education											
Unknown	8.3	8.2	8.3	8.4	8.2	8.4	8.4	8.1	8.3	8.3	8.3
Primary	37.6	37.5	37.7	35.2	38.8	35.3	35.1	38.5	39.0	39.0	39.0
Secondary	35.0	34.9	35.1	34.6	35.2	34.6	34.5	35.1	35.4	35.4	35.4
Tertiary	19.1	19.5	18.8	21.8	17.8	21.6	22.0	18.3	17.4	17.4	17.4
Parents separated											
Yes	32.5	32.0	32.9	27.5	35.0	27.0	28.0	34.7	35.4	35.4	35.4
No	67.5	68.0	67.1	72.5	65.0	73.0	72.0	65.3	64.6	64.6	64.6
Children in family	2.3	2.3	2.3	2.5	2.2	2.5	2.5	2.2	2.3	2.3	2.3
Individuals	34,045	16,839	17,206	11,213	22,832	5,668	5,545	11,171	11,661	11,661	11,661

Table 2: Variable means by gender and immigrant generation of untreated municipalities (keeping mother-tongue training).

Year	All	Boys	Girls	First-generation immigrants	Second-generation immigrants	Male first-generation immigrants	Female first-generation immigrants	Male second-generation immigrants	Female second-generation immigrants
	2009.3	2009.4	2009.3	2007.7	2009.7	2007.8	2007.6	2009.8	2009.7
Father's age	48.3	48.3	48.2	48.2	48.3	48.2	48.3	48.3	48.1
Mother's age	43.2	43.3	43.1	43.1	43.3	42.9	43.1	43.4	43.1
Father's education									
Unknown	10.2	10.2	10.3	9.7	10.4	9.6	9.7	10.4	10.4
Primary	28.0	28.2	27.9	22.2	29.6	22.4	22.0	29.8	29.4
Secondary	36.0	35.4	36.5	34.9	36.2	34.8	35.0	35.5	36.8
Tertiary	25.8	26.2	25.4	33.2	23.8	33.2	33.3	24.3	23.4
Mother's education									
Unknown	7.7	7.9	7.4	8.7	7.4	8.7	8.7	7.7	7.1
Primary	37.5	36.9	37.1	37.1	37.6	36.2	38.0	37.1	38.0
Secondary	35.4	35.3	32.7	32.4	36.1	33.1	32.2	35.8	36.5
Tertiary	19.4	19.9	21.5	21.8	18.9	22.0	21.1	19.4	18.4
Parents separated									
Yes	40.8	40.6	40.6	35.3	41.8	36.3	64.57	58.5	57.9
No	59.2	59.7	59.4	64.1	58.20	63.7	35.4	41.5	42.1
Children in family	2.2	2.1	2.2	2.2	2.2	2.2	2.2	2.1	2.2
Individuals	22,471	11,143	11,328	4,712	17,759	2,404	2,308	8,739	9,020

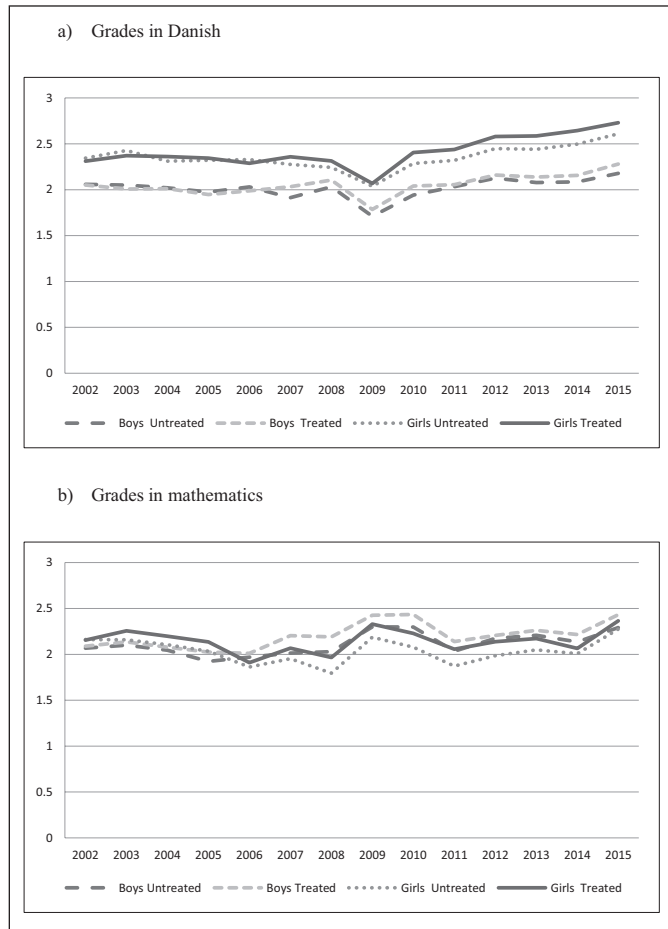


Figure 3: Unstandardised grade differences, treated and untreated municipalities, 2002–2015.12.¹⁰

treated (removing mother-tongue education) and untreated (keeping mother-tongue education) municipalities, differences are small but visible with students in treated municipalities performing better in Danish than students in untreated municipalities after the visible dip 2007–2008. This dip is possibly also related to the change in grading system in 2007. In mathematics there are visible differences between treated and untreated municipalities throughout the period.

Results using grades in Danish as outcome

Effects of the removal of mother-tongue education for grades in Danish are displayed in **Table 3**, with estimates from three different specifications being presented. The first model A includes year and municipality fixed effects. By including dummies for municipality, municipality-specific characteristics that remain constant over time are controlled for. It is, however, still possible (or even likely) that the reform correlates with characteristics that change over time at the municipality level, which is why municipality trends are included in the second

¹⁰ The grades in the '7-point scale' were for the purpose of Figure 3 translated to a 1–5 scale. See Appendix Table B.

Table 3: Effects of the mother-tongue training reform on standardised grades in Danish for immigrants and the second-generation immigrants from countries outside the EU, the EES, Greenland and the Faroe Islands – full sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
All		Boys	Girls	First-generation immigrants	Second-generation immigrants	Male first-generation immigrants	Female first-generation immigrants	Male second-generation immigrants	Female second-generation immigrants
<i>A. Controlling for municipality and year fixed effects</i>									
Estimate	0.058***	0.032	0.086***	0.040	0.035	0.031	0.058	−0.009	0.076***
Standard errors	(0.015)	(0.022)	(0.023)	(0.040)	(0.017)	(0.046)	(0.065)	(0.026)	(0.025)
<i>B. Controlling for municipality and year fixed effects, and municipality-specific trends</i>									
Estimate	−0.064	−0.076	−0.056	−0.074	−0.063	−0.138*	−0.029	−0.068	−0.064
Standard errors	(0.046)	(0.047)	(0.060)	(0.047)	(0.055)	(0.071)	(0.075)	(0.057)	(0.065)
<i>C. Controlling for municipality and year fixed effects, municipality-specific trends, socio-economic/demographic variables</i>									
Estimate	−0.063	−0.081*	−0.050	−0.065†	−0.065	−0.147**	0.000	−0.070	−0.064
Standard errors	(0.042)	(0.041)	(0.054)	(0.041)	(0.052)	(0.066)	(0.061)	(0.058)	(0.060)
Individuals	56,516	27,982	28,534	15,925	40,591	8,072	7,853	19,910	20,681

specification B. The third specification C adds a full set of socio-economic and demographic control variables, including parental education, parental labour-market participation, number of children in the family, parental age and a dummy indicating parental separation.

The first column in **Table 3** shows the results of the full sample. Effects are positive and small but statistically significant. When municipality-specific trends are introduced in the second specification, the estimate no longer remains statistically significant. Dividing the sample according to gender, clear differences are visible and we see that the positive results found in column 1 are driven by the results for girls, which are positive and significant in specification A. Again, these effects disappear when municipality trends are added. This can be explained by an overall municipality trend difference in grades for girls that is controlled for when municipality trends are included. The result remains the same when socio-economic variables are introduced in model C.

For boys there is a different pattern than for girls. No significant effects are found in model A or model B when municipality-specific trends are included, but when socio-economic/demographic controls are included in model C, there is a small but significant negative effect of 8% of a standard deviation. This means that when all controls are included we find a negative effect of removing mother-tongue education for boys, and no effect for girls. The expected gender differences are thereby confirmed. Girls tend to do better than boys in both the mother tongue (which could possibly be explained by more training in the household) and Danish, and they are therefore less affected by the removal of supplementary mother-tongue training than boys. Boys on the contrary perform worse than girls in Danish and thus it is possible that supplementary mother-tongue education would be more important for them; the removal of mother-tongue training thus leads to negative effects.

When studying outcomes for different immigrant generations (first- and second-generation immigrants), in column 4, there are no significant results in model A or B. In specification C, negative effects of about 7 % of a standard deviation are visible for first-generation immigrants (column 4), whereas no significant effects are found for the second generation (column 5). Once again this is a confirmation of expectations. Supplementary mother-tongue education is expected to matter more for first-generation immigrants than the second generation because of longer exposure to Danish. This is related to the critical age hypothesis, as second-generation immigrants, by definition, are born in the country.

When breaking down these groups according to gender, once again significant negative effects are found for male first-generation immigrants, and now the effects are somewhat stronger. There is 14% of a standard deviation lower-grade outcome in Danish for students in treated municipalities when controls for municipality-specific trends are introduced (in model B). The negative effect remains significant and increases slightly when further control variables are introduced in model C. This can be compared to a negative effect of 20 % of a standard deviation from being a first-generation immigrant compared to a second-generation immigrant and a negative effect of 30% of a standard deviation of being a boy in relation to a girl (in this study).¹¹ No significant results are found for first-generation immigrant girls (column 7).

For male second-generation immigrants, there are no statistically significant results and for girls no significant results are found when municipality-specific trends are added; however, excluding them, we find positive effects for girls belonging to the second generation.

The results for Danish show clear gender differences, thus confirming the third hypothesis. When municipality-specific trends are included, negative effects are found for all boys and for immigrant boys. For all girls and girls belonging to the second generation, results are instead positive, but only when excluding the trends. The results confirm the theoretical expectations of the removal of mother-tongue training having different effects for boys and girls.

¹¹ Full estimates are available from author upon request.

As girls have a higher proficiency in both the mother tongue and the second language, they are less affected by the removal of the additional training. Boys' grades in Danish are negatively affected by the removal, although effects are modest. The results for Danish furthermore show that the removal of mother-tongue education matters more for first-generation immigrants than second-generation immigrants, thereby confirming the fourth hypothesis. As mentioned previously, there are very few studies measuring the effects of supplementary mother-tongue training. However, the rather modest effect sizes of this study compare well with those in studies of bilingual education (see, Relji et al. 2015 for a meta-study).

Mathematics

Most research focuses on the effect of supplementary mother-tongue training on grades in the majority language of the immigrant-receiving country. It is, however, expected that the removal of mother-tongue education will have an effect on other school subjects as well. The basic argument here is that high proficiency in two languages will enhance overall problem-solving ability, which is beneficial for attainment in mathematics (Barwell et al. 2007; Clarkson 2007). It is, moreover, possible that students can ask the mother-tongue teacher for help with mathematics and receive an explanation in the mother tongue, which may be very beneficial in terms of achievement. According to the second hypothesis we expect a negative effect for the removal of supplementary mother-tongue education on grades in mathematics. **Table 4** displays results with grades in mathematics as the outcome. In general, the effects of the removal of mother-tongue training are negative. Column 1 presents the estimates for the full sample. A slight negative effect is found in model A, including municipality and year dummies. When socio-economic controls and municipality-specific trends are introduced in models B and C, negative effects become larger but no longer statistically significant.

Significant negative effects are found for boys, which are largely in line with the effects found when using grades in Danish as an outcome, although effects are somewhat stronger for mathematics, which is, to some extent, unexpected. Previous research has found a link between mother-tongue education and both the second language and mathematics, but the link between mathematics and mother-tongue proficiency has been described as somewhat weaker than the link between mother-tongue and the second language. This is not the case for boys in this study. There is 11% of a standard deviation lower grade in mathematics for boys in treated municipalities when socio-economic/demographic variables are introduced in model C. Turning to the results for girls in column 3, no significant effects are found.

For grades in Danish, no significant effects are found for the second-generation immigrants, whereas negative effects are found for second-generation immigrants in mathematics, column 5. In the first specification (A), there is a negative effect of 4% of a standard deviation, which becomes stronger in specification (B) and (C). According to the critical age hypothesis, time spent in the country matters for achievements in the second language and thus mathematics would be easier (if there is a higher proficiency in the language in which mathematics is being taught). Nevertheless, high-level language proficiency (in more than one language) increases the general problem-solving ability that would be beneficial for achievements in mathematics (Barwell et al. 2007). For some students belonging to the second generation, the proficiency may be higher in L2 than in L1 and thus they might need additional mother-tongue training to reap the benefits of bilingualism favorable for achievements in mathematics.

For mathematics no significant effects are found for first-generation immigrants, whereas negative effects are found for both boys and girls belonging to the second generation. The effects have the same size, which means that supplementary mother-tongue training matters for achievements in mathematics for both boys and girls (belonging to the second generation). The results for Danish (**Table 3**) show a clear gender division, with no effects for

Table 4: Effects of the mother-tongue training reform on standardised grades in mathematics for the first- and second-generation immigrants from countries outside the EU, the EES, Greenland and the Faroe Islands – full sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	Boys	Girls	First-generation immigrants	Second-generation immigrants	Male first-generation immigrants	Female first-generation immigrants	Male second-generation immigrants	Female second-generation immigrants
<i>A. Controlling for municipality and year fixed effects</i>									
Estimate	−0.027*	−0.034†	−0.021	−0.077	−0.039*	−0.007	−0.138**	−0.069**	−0.014
Standard errors	(0.013)	(0.020)	(0.021)	(0.041)	(0.022)	(0.053)	(0.061)	(0.031)	(0.024)
<i>B. Controlling for municipality and year fixed effects, and municipality-specific trends</i>									
Estimate	−0.056	−0.041	−0.065	−0.008	−0.076*	−0.043	−0.046	−0.046	−0.105**
Standard errors	(0.039)	(0.040)	(0.048)	(0.053)	(0.042)	(0.079)	(0.070)	(0.049)	(0.049)
<i>C. Controlling for municipality and year fixed effects, municipality-specific trends, socio-economic/demographic variables</i>									
Estimate	−0.056	−0.106***	−0.061	−0.006	−0.079**	−0.049	−0.065	−0.095**	−0.106**
Standard errors	(0.034)	(0.038)	(0.043)	0.053	(0.038)	(0.084)	(0.068)	(0.040)	(0.057)
Individuals	56,054	27,855	28,199	15,797	40,257	8,042	7,755	19,813	20,444

girls and negative effects for boys. For mathematics, the removal of mother-tongue training matters also for girls. As shown in **Figure 3**, girls tend to do worse than boys in mathematics, whereas the opposite is found for Danish. Girls might, in other words, need additional help with mathematics that can be obtained through help from the mother-tongue teacher (although this is not the primary purpose).

Socio-economic background

In general, estimates are sensitive to the inclusion of socio-economic and demographic background variables, which indicates that the reform correlates with other factors related to children's educational performance (grades). To understand what is driving these effects, the following analysis separates the sample according to the father's level of education.

The analysis in **Table 5** is divided according to four levels of education: (1) unknown education, (2) primary education, (3) secondary education and (4) tertiary education. No significant effects exist for students with fathers who have no registered education. Negative effects of 8 % of a standard deviation are found at a 10% significance level for students with fathers who have primary education when municipality-specific trends are included in model B, thus confirming hypothesis 5. Results stay basically the same when background variables are introduced in specification C. Clear negative effects are found for children of fathers with a university degree (20% of a standard deviation). This result can be explained by the fact that supplementary mother-tongue education was voluntary in Denmark and that it is more likely that children with fathers who have a university degree partook in the supplementary

Table 5: Effects of the mother-tongue training reform on standardised grades in Danish. Groups based on father's level of education – full sample.

	(1)	(2)	(3)	(4)
	Father's Education			
	Unknown	Primary	Secondary	Tertiary
A. Controlling for municipality and year fixed effects				
Estimate	0.058	0.046	0.092	−0.033
Standard errors	(0.047)	(0.039)	(0.022)	(0.041)
B. Controlling for municipality and year fixed effects, and municipality-specific trends				
Estimate	0.072	−0.082†	0.024	−0.207**
Standard errors	(0.112)	(0.049)	(0.041)	(0.066)
C. Controlling for municipality and year fixed effects, municipality-specific trends, and socio-economic/demographic variables				
Estimate	0.065	−0.084†	0.029	−0.199***
Standard errors	(0.114)	(0.050)	(0.041)	(0.067)
Individuals	5,739	16,149	20,257	14,718

Standard errors in parentheses are clustered at the municipality level. Socio-economic variables include parental labour-market participation, parental age, sex, parental separation and the number of children in the family. † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test).

training. Thus, they would also be more affected by the removal. Effects are highly significant and negative in both model B and model C. There are no visible differences including remaining socio-economic and demographic variables in model C, which means that parental education matters a lot for the effect of the reform.¹²

Robustness and placebo

Municipality reform sample

Until 31 December 2006, Denmark consisted of 270 municipalities. In 2007, a large reform merged a great number of municipalities so that 270 municipalities became 98 larger ones. This reform is unfortunately imposing some uncertainty on the analysis. The survey data at the municipality level was collected after the municipality reform of 2007; however, information on whether or not a municipality kept offering mother-tongue education is applied even before the municipality reform. Twenty of the municipalities with information in the survey did not change their borders and remain the same even after the municipality reform. To make sure the results found in the main specification are robust, a sensitivity analysis is performed with a restricted sample containing students resident solely in municipalities that did not change. **Table 6** displays the results from the analysis made with the municipality reform sample, with standardised grades in Danish as the outcome. The estimates displayed in **Table 6** follow the same pattern as the main analysis, which is reassuring. For girls, the coefficients are positive for Danish but not significant. Negative effects are found for boys; however, the effects are only significant for male first-generation immigrants. There is 16% of a standard deviation lower grade for first-generation immigrant boys in municipalities that did not keep mother-tongue training compared to municipalities that kept it for immigrants from outside the EU and the EES.

Placebo effects: immigrants from the EU and EES

Children from countries of the EU, the EES, Greenland and the Faroe Islands were, even after the reform, offered mother-tongue education in all Danish municipalities. Accordingly, there is no difference dependent on the municipality of residence. Studying the 'placebo' effects of the reform for these children, we should see no significant differences between treated and untreated municipalities.

Table 7 displays the effect of the reform on children belonging to the aforementioned countries, using standardised grades in Danish as the outcome. No significant results are found for this group. Furthermore, standard errors are large and, as expected, there is no indication that the reform affected this group in any way.

Conclusion

This study makes use of a policy change in Denmark that has removed mother-tongue education for immigrants and second-generation immigrant students in certain municipalities, whereas it was kept in others. The main political motivation of the reform was to increase immigrant integration by enhancing proficiency in Danish. This article shows no such outcome from the reform; instead, negative effects from the removal are found.

Five hypotheses are being empirically tested in this article. The analysis shows negative effects for the removal of mother-tongue education on grades in Danish, thereby confirming the first hypothesis. The results furthermore support the third hypothesis; removing

¹² See appendix, Table C for results in mathematics.

Table 6: Main results. Effects of the mother-tongue training reform on standardised grades in Danish for immigrants and the second-generation immigrants from countries outside the EU and the EES – municipality reform sample.¹³

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	Boys	Girls	First-generation immigrants	Second-generation immigrants	Male first-generation immigrants	Female first-generation immigrants	Male second-generation immigrants	Female second-generation immigrants
Estimate	-0.035	-0.034	0.013	-0.054	-0.043	-0.162*	0.061	-0.082	-0.001
Standard errors	(0.056)	(0.048)	(0.078)	(0.047)	(0.061)	(0.089)	(0.057)	(0.071)	(0.079)
Individuals	31,728	15,620	16,108	6,299	25,429	3,122	3,177	12,498	13,162

Standard errors in parentheses are clustered at the municipality level. All models include municipality and year fixed effects and municipality-specific trends. Socio-economic variables include parental labour-market participation, parental age, parental education, parental separation and the number of children in the family. Control for gender is included in columns 1, 4 and 5. † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test).

Table 7: Placebo effects of the mother-tongue training reform on standardised grades in Danish for immigrants and the second-generation immigrants from the EU and the EES – full sample.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	All	Boys	Girls	First-generation immigrants	Second-generation immigrants	Male first-generation immigrants	Female first-generation immigrants	Male second-generation immigrants	Female second-generation immigrants
Estimate	0.107	0.170	0.045	0.155	-0.160	0.274	0.081	-0.030	-0.202
Standard errors	(0.096)	(0.123)	(0.117)	(0.116)	(0.172)	(0.142)	(0.152)	(0.312)	(0.265)
Individuals	8,735	4,375	4,360	7,083	1,652	3,557	3,526	818	834

Standard errors in parentheses are clustered at the municipality level. All models include municipality and year fixed effects and municipality-specific trends. Socio-economic variables include parental labour-market participation, parental age, parental education, parental separation and the number of children in the family. Control for gender is included in columns 1, 4 and 5. † $p < .1$, * $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed test).

¹³ Results in mathematics available upon request.

mother-tongue education has negative effects on grades in Danish for boys but not for girls. This finding was expected because girls tend to have more mother-tongue training in the household and do better than boys in both the mother tongue and the majority language. Boys are, in other words, more dependent on additional teaching and support in the mother tongue in schools.

This study, furthermore, assesses the effects of the removal of mother-tongue education on grades in mathematics. According to the second hypothesis, it was expected that the removal would lead to negative effects also for grades in mathematics. There are a number of reasons why the removal should matter also for these grades. First, multilingualism enhances general problem-solving ability and thus proficiency in both the mother tongue and the second language; this is beneficial for mathematics. Second, mother-tongue teachers may be an additional help in explaining mathematics in the students' first language, and third, additional time spent in school may enhance overall attainment. This article finds negative effects on mathematics from the removal of mother-tongue education, thereby confirming the second hypothesis.

No effects are found for second-generation immigrants for grades in Danish, whereas negative effects are found for first-generation immigrants. This is according to expectations, as time of exposure to the majority language will matter for the outcome and the importance of mother-tongue training will thus differ between these groups. Negative effects are, however, found for both boys and girls belonging to the second generation in mathematics, which may seem an unexpected result. However, second-generation immigrants may have a lower proficiency in the mother tongue compared to first-generation immigrants and may be more in need of this training. As multilingualism can be linked to achievements in mathematics, there is a negative effect when mother-tongue education is removed.

It is evident that negative effects are found for children with fathers who have a university education (possibly because of a higher uptake in this group); however, we also see effects for children with parents with only primary education. This is interpreted as children who are more in need of additional support in school are more negatively affected by the removal.

Increasing educational attainment of first- and second-generation immigrants is important because they are falling behind in the Danish labour market. This is particularly true for individuals originating from countries other than countries of the EES and the EU. The political aim of the policy reform introduced in 2002 was to increase the assimilation of these groups and by removing mother-tongue training, it was believed that immigrant children would increase their proficiency in Danish, which would, in turn, increase labour market integration. This study shows that such positive effects of the reform are not found. Rather the opposite has occurred; the removal of mother-tongue training leads to lower grades in Danish for boys and in mathematics for boys in general, and boys and girls belonging to the second generation. Although effects are modest, this study provides evidence that mother-tongue education matters for the educational achievement of children with a background in countries other than the EU and the EES. If the motivation of Danish educational policies directed towards first- and second-generation immigrants is to enhance immigrant integration, the removal of mother-tongue education should be reconsidered.

Appendix

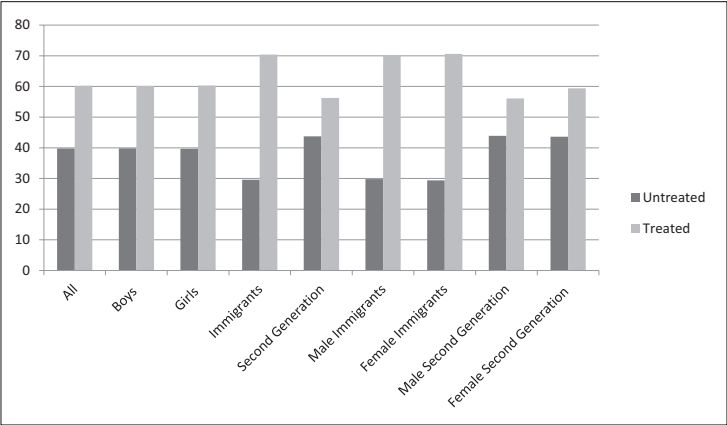


Figure A: Share of individuals residing in treated/untreated municipalities.

Table A: List of municipalities: Treated/untreated. Main sample and municipality reform sample.

Main Sample		Municipality Reform Sample	
Treated	Untreated	Treated	Untreated
Albertslund, Allerød, Bornholm, Brøndby, Dragør, Egedal, Fredensborg, Frederiksberg, Frederiksund, Furesø, Gentofte, Gribskov, Halsnæs, Helsingør, Hillerød, Hvidovre, Høje-Tåstrup, Ikast-Brande, Lyngby-Taarbæk, Tårnby, Herning, Favrskov, Holstebro, Horsens, Norddjur, Odder, Ringkøbing-Skjern, Silkeborg, Skanderborg, Skive, Syddjur, Viborg, Aarhus, Brønderslev, Hjørring, Læsø, Rebild, Thisted, Vesthimmerland, Aalborg, Greve, Lemvig, Guldborgsund, Kalundborg, Køge, Lejre, Lolland, Samsø, Næstved, Slagelse, Solrød, Sorø, Stevn, Assen, Billund, Esbjerg, Fåborg-Midtfyn, Kolding, Nyborg, Odense, Svendborg, Tønder, Varde, Vejen, Åbenrå, Faxe, Middelfart, Nordfyn, Vejle, Årø (n = 70)	Copenhagen, Roskilde, Randers, Sønderborg, Ballerup, Gladsaxe, Frederikshavn, Ringsted (n = 8)	Albertslund, Allerød, Bornholm, Dragør, Frederiksberg, Helsingør, Hvidovre, Høje-Tåstrup, Lyngby-Taarbæk, Tårnby, Odder, Aarhus, Læsø, Greve, Solrød, Odense (n = 16)	Copenhagen, Ballerup, Gladsaxe, Ringsted (n = 4)

Danish municipalities not included in the analysis are the following: Herlev, Ishøj, Fredericia, Haderslev, Glostrup, Vallensbæk, Holbæk, Vordingborg, Fanø, Rudersdal, Hedensted, Mariagerfjord, Jammerbugt, Rødovre, Odsherred, Hørsholm, Kerteminde, Stevn, Morso, Langeland (n = 20).

Table B: Grades '7-point scale' and equivalent ETCS grade.

Danish grade	Explanation of grade	Equivalent ETCS grade	Equivalent number in paper
12	Excellent performance	A	5
10	Very good performance	B	4
7	Good performance	C	3
4	Fair performance	D	2
02	Adequate performance	E	1
00	Inadequate performance	Fx	0
-3	Unacceptable performance	F	0

Table C: Effects of the mother-tongue training reform on standardised grades in mathematics. Groups based on father's level of education – full sample.

	(1)	(2)	(3)	(4)
	Father's education			
	Unknown	Primary	Secondary	University
<i>A. Controlling for municipality and year fixed effects</i>				
Estimate	-0.068	-0.010	0.003	-0.075**
Standard error	(0.044)	(0.025)	(0.022)	(0.030)
<i>B. Controlling for municipality and year fixed effects, and municipality-specific trends</i>				
Estimate	-0.012	-0.020	-0.012	-0.195**
Standard error	(0.116)	(0.041)	(0.040)	(0.072)
<i>C. Controlling for municipality and year fixed effects, municipality-specific trends, and socio-economic/demographic variables</i>				
Estimate	-0.017	-0.019	-0.010	-0.189**
Standard error	(0.117)	(0.042)	(0.040)	(0.073)
Individuals	5,704	15,980	20,093	14,277

Competing Interests

The author has no competing interests to declare.

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