Tracked and Segregated: The Effect of Early Informal Within-School Tracking in Schools with Students with Low Socioeconomic Status or Roma Ethnicity[1]

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Tracked and Segregated: The Effect of Early Informal Within-School Tracking in Schools with Students with Low Socioeconomic Status or Roma Ethnicity. While between-school tracking has been a well-explored topic especially with countries tracking their educational systems as early as at the age of 10, within-school ability grouping has received comparatively less analytical attention. This paper explores effects of within-school informal tracking practices at socioeconomically and ethnically mixed elementary schools. In Slovakia, where these practices were previously described as linked to segregation of Roma students, they result in academically, socioeconomically, and ethnically distinct separate classes in a school. We try to identify the early tracking practices of schools by exploring if two or more classes included in the TIMSS 2019 assessment in a particular school display extreme differences with regard to ethnic (Slovak vs. Roma) or socioeconomic (defined by parental education levels or occupation) composition. We employ a series of hierarchical linear models to assess the impact of early within-school informal tracking on mathematics and science test results of students from low-track classes. We check the robustness of our findings in a parallel propensity scores approach. Our results confirm that class-level segregation seems to have a very significant connection to academic performance of students from low-track classes. When compared to identical students from non-tracked classes, students from low-track classes have more than 15% lower test scores in mathematics and science. This points to the need to further explore early informal within-school tracking practices which have so far escaped analytical attention. While not a topic of cross-national assessment programs per se, this can be done using data from major international assessments.

Sociológia 2024, Vol. 56 (No. 2: 154-181)
https://doi.org/10.31577/sociologia.2024.56.2.6

Key words: *Early tracking; within-school tracking; informal tracking; Roma; TIMSS*

Introduction

Out of the institutional features of education systems, tracking (differentiation) is widely considered the most influential with respect to its effect on student academic outcomes and inequality of educational opportunity (IEO[4]) (Bol et al. 2014; Brunello – Checchi 2007; Marks 2005). The discussion on the impact

[1] This work was supported by the Slovak Research and Development Agency (SRDA) [grant number APVV-22-0242].

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[4] We draw on definition of IEO by Van de Werfhorst and Mijs as "the influence of social class and race/ ethnicity on students´ test scores" (2010: 408) and of Skopek, Triventi and Buchholz (2019), based on Roemer (1998), as "the degree to which educational resources, environments and achievements are unequally distributed across those status characteristics that are beyond students´ influence" (Skopek – Triventi – Buchholz 2019: 214).

of tracking – which we understand as "the practice of allocating students into school programs or classes that are homogeneous in terms of 'cognitive ability'" (Bol et al. 2014: 1547) – has been inconclusive for a long time, with results largely depending on available data, research designs, and employed concepts of educational inequality (Strello et al. 2021). Although current studies seem to agree on the main conclusions, these conclusions are made based on studies that focus mostly on particular forms of tracking. Meanwhile, other forms of tracking remain under-researched despite their potential importance for the overall picture. Our study focuses on one of these specific types of tracking – a very early informal (unreported) internal (within-school) tracking. We study the impact of this type of tracking in socioeconomically diverse elementary schools (ISCED 1 level of the regular education system) in Slovakia with a relevant share of children with very low socioeconomic status or Roma ethnicity.

The motivation of our research is two-fold. First, we would like to add to the existing body of research on tracking and social stratification in education by focusing on internal informal tracking. Specifically, we aim to examine whether this under-researched form of tracking has a significant effect on the education achievement of students, and if so, how pronounced this effect is. Most of the studies on tracking have so far focused on *formal external* tracking that starts around *the age of 10 or later*, depending on the country. In contrast, *informal* and *internal* (within-school) tracking practices usually escape the attention of cross-country comparative analyses that use large data sets from international assessments such as Programme for International Student Assessment (PISA), Progress in International Reading Literacy Study (PIRLS), and Trends in International Mathematics and Science Study (TIMSS). Only few researchers have attempted to do so, despite the potential impact of these forms of tracking on the IEO (Skopek et al. 2019; Van de Werfhorst – Mijs 2010). Informal tracking exists, more or less visibly, in many countries (Skopek et al. 2019) and although it is not in place *de iure*, *de facto* it might direct students to relatively fixed, in many cases only hardly reversible education paths (Hapalová – Vančíková 2019). Moreover, it often occurs even earlier than formal tracking, even as early as in elementary schools. Research shows that the earlier the tracking occurs, the stronger its impact is (Woessmann 2009). Similarly, although internal tracking has been studied to a much lesser extent compared with the external one, we assume that there might be the same inequity-strengthening mechanisms at play. In particular, the circumstance of high and low-track co-existing close to each other "under one roof" seems likely to exacerbate the labelling effect (Oakes 2005) that impacts on the students´ academic self-concept and teachers´ expectations. According to the

differentiation-polarization theory, tracking creates polarization that leads to developing "antiacademic attitudes (…) among students who are labeled failures, whereas proacademic attitudes develop among students who are labeled successes" (Abraham 1989; Ball 1981; Hammersley 1985; Hargreaves 1967; Lacey 1966, 1970, 1974, as cited in Fleischmann et al. 2023: 3).

The second motivation of our research is the comparatively high level of education inequality in Slovakia (Herrera Sosa et al. 2015: 8-9), with very large education achievement gaps between three pairs of groups of students: the rich and poor students, the students visiting different types of school (gymnasiums and vocational schools), and the non-Roma and Roma students[5]. One of the main factors that explain such a pronounced variance in student achievement is the significant social stratification of schools, which goes hand-in-hand with the early tracking system (Herrera Sosa et al. 2015: 9). Qualitative studies, media, and NGOs in Slovakia (for example, Gdovinová 2018; Kriglerová ed. 2015; Kusá 2016; Svoboda 2013: 16) have documented that, in addition to between-school tracking, there are also informal tracking and segregatory practices taking place within Slovak elementary schools. However, there are no quantitative representative data on the scope and impact of the phenomenon yet. Thus, we have chosen socioeconomically diverse elementary schools with a relevant share of children with very low socioeconomic status or Roma ethnicity (as the groups most endangered by the inequities stemming from the socioeconomic disadvantages in the Slovak education system (Herrera Sosa et al. 2015: 8-9) in Slovakia as the place to study impacts of very early internal informal tracking. We aim to establish if this type of tracking has a significant impact (controlling for other factors) on the results of these students and how significant this impact is.

In order to identify hard-to-spot informal tracking within schools, we build on previous research on tracking (in general) that shows a very high correlation between socioeconomic status and race/ethnicity on the one hand and track allocation and achievement on the other (Dupriez et al. 2008; Gamoran – Berends 1987; Hallinan 1994). In everyday life of schools, these are intertwined to the extent when it is difficult to draw a clear line between tracking (based on the meritocratic principle) and segregation (which is rooted in ascriptive factors, such as socioeconomic background, ethnicity, gender,

[5] According to the PISA measurement, achievement gap between the top and bottom ESCS (Economic, Social, and Cultural Status) quintiles in Slovakia is the equivalent to almost four years of schooling, significantly more than elsewhere in the EU and also equivalent to the length of upper-secondary education in many countries (Herrera Sosa et al. 2015: 26). The gap between students from general secondary schools – gymnáziums - and from vocational secondary schools, the latter ones being disproportionately visited by students from socioeconomically disadvantaged background, is equivalent to almost three years of schooling (Herrera Sosa et al. 2015: 29). The largest performance difference in PISA scores (about 160 points) is between Roma and non-Roma students, corresponding to almost five years of schooling (Bednarik – Hidas – Machlica 2019: 16-17).

etc.). In socioeconomically and ethnically heterogeneous school environments, tracking is usually a driver of segregation. Therefore, we use the socioeconomic status and ethnicity of students and their parents as an indicator of track allocation (separation) of students in elementary schools in Slovakia. We identify pairs of classes within schools that are clearly distinct with regard to socioeconomic status and ethnicity and explore the impact of such a separation on the academic results of students. This approach is justified by the presence of an informal system of two-fold allocation of students into classes in some schools in Slovakia – based on their academic results and, at the same time, on their SES and ethnicity, reported in the literature (Huttová et al. 2012; Kusá 2016). These allocation practices result in the existence of classes (within one school) that are both academically and socioeconomically/ethnically distinct (Kusá 2016).

Overall, our paper is the first to focus on a) very early informal internal tracking using a large international assessment (TIMSS 2019) and the first to analyze b) tracking in situations where low-track classes concentrate children with very low socioeconomic status or Roma ethnicity. Our main research question is what impact does attending an academically tracked and socioeconomically or ethnically segregated class within a school have on the academic results of the students from the low-track class. Our hypothesis is that being in a tracked class with students with very low levels of SES or with Roma ethnicity has a particularly significant negative impact on the academic results of the low-track students.

Tracking

Tracking as a concept and as a practice is present in contemporary societies to the extent that it could be argued that all educational systems are more or less tracked, that is, virtually all of them tend to select and sort students into different schools, classrooms, or courses based on student preferences and/or abilities (Blossfeld et al. 2016; Bol et al. 2014: 1548; Dupriez et al. 2008; Kerckhoff 1995: 331; Van de Werfhorst – Mijs 2010). Although some authors (for example, Hanushek – Woessmann 2006) discern between *tracked* and *comprehensive (non-tracked)* education systems (i.e., with or without tracking), a more precise classification of education systems is one based on the degree of presence of tracking (Bol et al. 2014). This is measured as a composite index based on multiple indicators such as tracking age (age of first selection), length of the tracked curriculum, scope of separation of students (school/class level; whole day tracks or temporary 'streams' only for specific subjects), number of different tracks or curricula, potential and actual between-track mobility, and

percentage of students in vocational track (see, for example, Bol et al. 2014; Bol – Van de Werfhorst 2013; Lavrijsen 2013; Shavit – Müller 1998). According to this view, even the formally comprehensive education systems (for example, in Anglophone countries such as England, the United States, Australia or Ireland) implicitly involve some forms of differentiated schooling (Skopek et al. 2019: 218-9). This, in turn, poses a conceptual and methodological challenge in how to capture the less obvious forms of tracking.

In our research, we draw on a typology developed by Blossfeld et al. (2016) who differentiate between four forms of tracking based on two criteria: *externalization* (whether tracking occurs between schools or within them, i.e. between classes and courses) and *formalization* (whether tracking is regulated, recognized by law and discernible in school certificates and qualifications or is not recognized formally, but the heterogeneity between or within schools in terms of quality of instruction, learning equipment, composition of student body etc. significantly impacts learning opportunities, experiences, and achievement of students) (Skopek et al. 2019: 218). Based on these two criteria, Blossfeld et al. recognize 4 "ideal types" / forms of differentiation (tracking) that coexist and overlap in "real world of school systems" (formal external, formal internal, informal external, informal internal differentiation). The form of tracking explored in our research is informal internal differentiation – sorting students within schools into different classes at the discretion of teachers or the school principal, e.g., different ability classes (Blossfeld et al. 2016; Skopek et al. 2019: 218).

Effects of tracking

The proponents of tracking argue that separating students into academically homogeneous groups leads to maximizing student achievement via better specialization, and addressing the needs, abilities, and interests of the specific student population[6] (Brunello – Checchi 2007: 785; Gamoran et al. 1995: 688; Hallinan 1994; Hanushek – Woessmann 2006; Van de Werfhorst – Mijs 2010: 415). However, these beliefs are not well substantiated empirically (Bol et al. 2014: 1548). Results of studies and meta-studies of various research designs are mixed. These effects are measured through three different indicators of the educational effectiveness and (in)equality: a) *Impact of tracking on the average results of students* **–** studies and meta studies using this measure show either that tracking does not have an effect or has a detrimental effect (Brunello –

[6] According to this belief, in heterogeneous classes, it is much more difficult to give weaker students the attention they need, there is a greater risk of them feeling unseen, inferior and unmotivated. This can lead to loss of interest in learning and low self-confidence (Kusá 2016: 102; Svoboda 2013: 17).

Checchi 2007; Duru-Bellat – Suchaut 2005; Figlio – Page 2002; Gamoran – Mare 1989; Hanushek – Woessmann 2006; Skopek – Triventi – Buchholz 2019; Strello et al. 2021: 159; Van de Werfhorst – Mijs 2010: 421); b) *Impact of tracking on the dispersion of the test scores (i.e., inequality in learning)* **–** in this case, the evidence is mixed (Van de Werfhorst – Mijs 2010: 416). Some cross-country studies show that the level of dispersion in achievement tests is higher in early-tracking countries (Hanushek – Woessmann 2005); or more specifically, that tracking leads to an increase in inequality (Strello et al. 2021: 158) by depressing low-performing children (Hallinan 1988; Hallinan – Kubitschek 1999; Huang 2009) and/or disproportionately benefitting high-performing children" (Ammermüller 2005; Betts 2011; Gamoran – Mare 1989; Hallinan 1994: 80; Hanushek – Woessmann 2006; Huang 2009; Schütz et al. 2008). However, other studies contested the hypothesis (for example, Duru-Bellat – Suchaut 2005; Micklewright – Schnepf 2006); and c) *Impact of tracking on the IEO by social background and race/ethnicity* – most of these studies show a negative impact of tracking, i.e., that inequalities are magnified by educational differentiation (Hallinan 1994: 80; Skopek et al. 2019: 228; Van de Werfhorst – Mijs 2010: 417). The link between social/family background and the school results tends to be stronger in countries with a higher level of differentiation and in countries that sort students early (Ammermüller 2005; Brunello – Checchi 2007; Duru-Bellat – Suchaut 2005; Hanushek – Woessmann 2006; Horn 2009; Marks 2005; Schütz et al. 2008; Skopek et al. 2019). Similarly, studies show that tracking is linked to ethnic/race inequalities both in performance (Crul – Holdaway 2009; Entorf – Lauk 2008; Hallinan 1994: 80), track mobility (Hallinan 1996), and track allocation (Oakes 1990).

In sum, the research on tracking has found mostly zero or negative effects of tracking on educational inequalities. Two types of mechanisms that theoretically explain this impact are identified: (Bol et al. 2014: 1548): a) *The social selection mechanisms (mechanisms before and during the allocation to tracks)* – Socioeconomic (and ethnic) background plays an important role during the process of educational decision-making of students and parents and in the allocation of students to different tracks (Brunello – Checchi 2007: 784), especially when tracking occurs at a younger age (Bol et al. 2014: 1548). Because SES gaps in cognitive abilities and skills are marked already before children enter school (Bradbury et al. 2015), socially disadvantaged students and students from minorities tend to be concentrated in low tracks (Hallinan 1994), and students with a more affluent and majority background tend to be concentrated in high tracks. At the same time, students from minorities and socially disadvantaged students are not only less likely to have academic results for the high track (Brunello – Checchi 2007), but they are less likely to

choose the high track, to be recommended by a teacher into the high track, and even to get in with the same or similar academic results as students with a more affluent background (Blossfeld et al. 2016); and b) *Mechanisms after allocation to tracks* – Different learning environments in various tracks may create differences in curriculum, instructional quality, pace, materials and resources available, attractiveness, and thoroughness of learning, reinforce peer effects and self-fulfilling prophecy effects via different classroom composition, norms and aspirations, teachers´ expectations, labelling and teacher-student interactions (Bol et al. 2014: 1548; Brunello – Checchi 2007; Entorf – Lauk 2008; Hallinan 1994: 80; Skopek et al. 2019: 216; Veselý – Matějů 2010: 63-66).

Overall, the impact of tracking on IEO can be framed through the principle of cumulative advantage and disadvantage (DiPrete – Eirich 2006): As prior achievement and educational decision-making are related to SES and race/ethnicity, and both significantly affect the allocation of the track, academic achievement of a student, and the learning conditions in the track, the higher SES and majority children disproportionately reap the benefits of differentiation in education system (Hallinan 1994; Skopek et al. 2019: 216).

Tracking and segregation in elementary schools in Slovakia

Slovakia is among the countries with the most tracked educational systems, both according to studies using single indicators (Brunello – Checchi 2007; OECD 2020; Strello et al. 2021; Woessmann 2009) and composite measures of tracking (Bol et al. 2014: 1557; Bol – Van de Werfhorst 2013: 26). While these studies use official statistics on formal tracking, there are also various informal selective mechanisms in the Slovak education system (see below) (Hapalová – Vančíková 2019; Kriglerová ed. 2015; Svoboda 2013: 16). Typically, the multipath education system in Slovakia has been researched with an emphasis on the segregation aspect of these practices (Kusá 2016: 39). One reason for the focus on segregation instead of tracking might be the marked problem of both spatial and school segregation[7] of the Roma minority in Slovakia. Examples of segregation in education have been documented by academic researchers, media, state institutions and non-government bodies (Friedman et al. 2009; Hapalová 2019; Hapalová – Hvozdovič 2013; Kriglerová ed. 2015; Lajčáková et al. 2017; Rafael ed. 2011; and others). They occur at many levels of the

[7] 65% of 6-15 years old Roma pupils are educated in classes with almost or exclusively Roma students. This makes Slovakia the EU Member State with the highest share of Roma segregation in education (European Commission, 2023).

education system – in pre-schools, elementary and high schools, in regular as well as special schools, on school level and - crucial for our paper - on class level too (Hapalová 2019). In regular education, segregated schools or segregated classes within ethnically mixed schools might be the result of demographic development of the area, direct or indirect segregatory delimitation of school districts, or by school policies in reaction to the educational "white flight" that is enabled by the right of parents to choose a school for their children (Hapalová 2019; Huttová et al. 2012: 89; Kriglerová ed. 2015). Within schools, segregated Roma classes can paradoxically also emerge as an unintended outcome of public policy measures that were implemented to improve the education opportunities of Roma students, such as "zero grades" and specialized compensatory classes (see more below). Segregation in education has been one of the reasons why the European Commission has decided to refer Slovakia to the Court of Justice of the European Union in 2023, an act that followed the infringement proceedings against the Slovak Republic (since 2015), together with the Czech Republic (2014) and Hungary (2016) (European Commission 2023).

Roma segregation in education is in many schools and areas concomitant with a probably even more widespread practice of tracking, that occurs to a different extent and in various - more or less formalized - forms on all levels of the Slovak education system (Kriglerová ed. 2015; OECD 2010). According to cross-national studies such as PISA and TIMSS, Slovakia is among the countries with the earliest start of *formal* tracking, with 10-11 years as the age of first selection. However, the earliest *informal* tracking and selection practices occur even earlier, in many cases as early as before the start of the elementary school (i.e., at the age of 6-7) (Hapalová – Vančíková 2019; Kriglerová ed. 2015; Kusá 2016: 40-41). In schools with a socioeconomically and ethnically heterogeneous student population, distinguishing between tracking and segregation is very problematic, as these two types of selection mechanism are deeply intertwined both in the assigning processes, in the education processes taking place in the created classes, and in the narratives and rationales of the involved actors (educators, parents, students).

Academically, socioeconomically, and ethnically homogeneous and separated (tracked) classes emerge as a result of three types of selection practices: a) they are initiated by schools: school enrollment assessments; parallel classes, sometimes with different types of curriculum; b) they are created as a result of specific education policy measures that are aimed to address the needs of disadvantaged students: compensatory classes; until 2022 zero grades; c) they are intended and to some extent regulated by the school law as "official"

tracks: classes for gifted children and special classes in regular schools[8]. Most of these practices are not explicitly regulated by the education act as an intent to establish an official track. Thus, we might include them under the informal type of tracking as defined by Blossfeld et al. (2016).

We identify five forms of informal tracking: *a) Various, more or less standardized forms of assessment at school enrolment (age 6-7)* – (Kriglerová ed. 2015; Kusá 2016: 107) decide whether a child is prepared for school attendance; whether a child is accepted into the specific school or not; and sometimes also to which class a child is assigned. Besides regular classes, there are also special classes/special schools, classes for gifted children, and in some cases, schools also offer classes with an extra focus on foreign languages, sports, etc. (see more below). School enrolment assessment practices, level of their quality and difficulty are highly varied (Kusá 2016: 107; Vančíková 2019b). b) *Parallel classes within one grade that use a different curriculum and have a different academic and/or socioeconomic and ethnic population of students* – classes with a special focus on foreign languages, STEM, sports, etc. can be found in many elementary schools (Huttová et al. 2012; Kriglerová ed. 2015). There are no exact data on the scope of this phenomenon yet[9]. Students are enrolled in these classes either as early as during the ISCED 1 level or often before the 5th grade (i.e., the start of ISCED 2). Enrollment can be based on previous academic results, admission tests, teacher recommendation, and, not exceptionally, also on parental choice / preference. Many schools offer the exclusive 'high-track' classes as a tool in the race for parents´ favor (Huttová et al. 2012; Kusá 2016). c) *Zero grades* – were established as a tool to improve school readiness and educational opportunities for socially disadvantaged children. Designed as a temporary measure, they eventually evolved into the main compensatory public policy tool aimed at children of the poorest, marginalized Roma communities (Vančíková 2019c). However, students from these ethnically, linguistically, socioeconomically, and academically homogeneous and at the same time disadvantaged classes often continued together in the same or a very similar collective also in the following grades (Huttová et al. 2012: 69; Kriglerová ed. 2015; Kusá 2016; Vančíková 2019c). Since the 2022 legislation change, zero grades are no longer a part of the education system (Education Act 2008). d) *Specialized compensatory classes for students who are "not supposed to successfully master the learning content of the given*

[8] Special classes are designed for intellectually disabled students. Although they can be in a regular school, they belong to the system of special, not regular education and thus, they are excluded from the official statistics and assessments.

[9] Kusá (2016) in her qualitative study of inclusive environments in Slovak schools, identified some form of dividing students between the exclusive and the 'residual' classes in at least half of the 26 studied schools.

year" (Education act 2008) – have been established, similarly to zero grades, as a support tool for socially disadvantaged students (Lajčáková et al. 2017). These classes have a lower number of students (maximum 8), an adjusted curriculum, and students can visit them for a maximum of one year. Again, they are visited almost exclusively by disadvantaged Roma students and, as such, contribute to segregation (Hapalová 2019). e) *(Schools and) classes for gifted children* – include a relatively small percentage of students[10]. Children can be assigned to these classes as early as at the age of 6 (mostly in case of classes or schools for children with a "general intellectual gift" (Education Act 2008)) or before entering the ISCED 2 level (the fifth grade).

The presence of these and other tracking and selection practices in Slovak schools is a result of two features of the education system (Zimenová 2013: 34): a) the right of parents to choose a school for their child and b) the per capita financing of schools. These two features combine to create a high level of competition between schools (Kusá 2016)[11]. In the race for students, schools tend to offer homogeneous classes and exclusive programs that are aimed especially at parents from the middle and upper social class (Huttová et al. 2012; Kusá 2016: 40). At the same time, tools that would sufficiently help to include students with different needs in schools are insufficient or lacking (Huttová et al. 2012; Kriglerová ed. 2015; Svoboda 2013; Zimenová 2013). Consequently, parents, especially from higher social classes and/or with gifted children (Vančíková 2019a), do not trust the ability of the education system to provide students with individual support, address their needs and develop their potential fully, and they look for opportunities to improve learning conditions for their children. This in turn leads to a significant (both in the extent and the impact) socioeconomic, ethnic, and academic separation of students (Hapalová – Vančíková 2019; Kusá 2016). In ethnically and socioeconomically diverse schools, the lower track classes become the common place for Roma students, students with special needs, students repeating a year, and students with problematic behavior (Kusá 2016: 106). Here, the learning process is heavily influenced by low expectations, lack of motivation, and frequent disciplinary problems (Kusá 2016: 105). It is not uncommon that even students with previously mediocre results deteriorate towards very weak ones (Kusá 2016: 109).

[10] The number of students who are educated in the classes or schools for intellectually gifted children remains stable between 3000 and 3500 (according to statistics since 2009). However, this number represents more than 70% of all students who are diagnosed as intellectually gifted.

[11] The level of between-school competition in Slovakia is very high even in the OECD countries comparison (OECD 2014). School systems with low levels of competition among schools often have high levels of social inclusion. By contrast, in education systems where parents can choose schools, and schools compete for enrollment, schools are often more socially segregated (OECD 2014).

To establish the effect of the tracking practices listed above, we rely on the Trends in International Mathematics and Science Study (TIMSS) 2019 which establishes proficiency in mathematics and science at the end of the ISCED 1 cycle in the fourth grade. The TIMSS study is fielded every four years since 1995 by the International Association for the Evaluation of Educational Achievement. In 2019, 64 countries participated in the study. Aiming at students from the fourth grade, TIMSS provides the earliest data available with regard to academic performance of students in schools in Slovakia. While the survey does not include information on the presence of tracking practices, it provides sufficient measures of the socioeconomic background of the students. To identify tracking, we rely on studying the heterogeneity in parental socioeconomic composition of classes within a school.

Data and methods

To identify tracking practices at schools we rely on a combination of the main TIMSS 2019 dataset with the TIMSS 2019 "bridge" data. TIMSS changed the mode from pen and paper to CAPI in the 2019 wave. To control for effects of the changed mode, a separate smaller "bridge" sample using the original pen and paper mode was fielded together with the main sample which used CAPI. Both samples are stratified random samples of schools and intact classes of students, while both samples are not selected independently of each other. As it was not possible to administer both modes to the same classes an optimal sampling strategy was developed to make the bridge samples as comparable as possible to the main samples (LaRoche – Foy 2020: 9.58). Schools in Slovakia were sampled based on their language of instruction (Slovak, Hungarian), size (small, large) and average math score in national testing (low, medium, high, missing) (LaRoche – Foy 2020: 9.220). A particularly valuable feature of combining the main and the bridge datasets for the purposes of our paper is that it increases opportunities to identify a "tracked" class in a school. While the main dataset samples two classes from a school (and only one class, if there is only one class in the fourth grade), the bridge dataset adds another class to the data for schools which were selected for both independent samples. The main TIMSS 2019 dataset includes 4 247 students from 157 schools while the bridge data has 1 610 students from 70 schools. The combined dataset includes 5857 students, 362 classes and 203 schools. Of the 203 schools 133 have at least two classes in the sample, 24 schools have three classes, and one school has four classes.[12] As the total population of fourth grade students in Slovakia in 2019

[12] There were on average 1.5 classes in the fourth grade in schools in Slovakia in 2022.

was 52 222 students across 2 000 schools (LaRoche – Foy 2020: 9.13), our sample includes over eleven percent of the analyzed student population.

Identifying tracking

The standard TIMSS questionnaires do not include a question if the school uses any sorting mechanisms to create tracked or special classes (TIMSS maps only within-class ability grouping in the teacher questionnaire). We try to identify such schools by examining the differences in socio-demographic characteristics of the parents in classes within a school. If this composition differs to a large extent, it is highly probable that the school does not use a random class-assignment of students but relies on some form of sorting mechanisms aligning parental characteristics with placement into a particular class in the school. To identify tracked classes with children with parents with very low levels of SES or with Roma ethnicity, we compare a) the share of households with Romani speakers[13], b) the share of parents without work experience or in jobs requiring no qualification and c) the share of parents with elementary school education within classes from individual schools.

To identify large differences in the socio-demography of parents empirically, we rely on the classic Dissimilarity Index D (Duncan – Duncan 1955). This is a simple and frequently used measure of unevenness of the distribution of a characteristics still used in recent research on school segregation (Strello et al. 2022). In our case we analyze the distribution of the three characteristics among classes of the same school and identify early tracking schools if the dissimilarity index is higher than 0.33. These are schools where at least a third of the students would need to change class to attain an even distribution of the respective attribute.

This way we identify 5 schools suspect of early tracking based on the Romani language attribute, 6 schools based on the distribution of non-qualified work among parents and 5 schools based on the share of parents with elementary school education. There is some overlap between the three methods – two schools have been identified as suspect of tracking practices by all three approaches.

Dependent variables

To measure school performance, we use proficiency scores in mathematics and science which are available as a set of five ‘‘plausible values” in the TIMSS datasets. To limit the burden of the students, each has to answer only a selected

[13] Not all Roma in Slovakia speak the Romani language. According to the 2011 census, 14% of Roma in Slovakia identify Slovak and 9.9% Hungarian as their maternal languages.

group of questions. TIMSS uses a complex procedure to combine these results into a set of five plausible values which are internationally standardized to an average of 500 and a standard deviation of 100. To account for this procedure, we calculate each of our models five times for each plausible value as a dependent variable and present the average as the resulting figure.

Independent variables

Our main independent variable is the presence of tracking practices in ethnically and socioeconomically diverse schools visited by a relevant share of children with very low levels of SES or with Roma ethnicity. We use three alternative identifications of tracking to create dummy variables indicating that a student is in a low-track class. This can be a class where a disproportionately large share of students a) is from households where Romani language is spoken, b) has parents who do not work or work in jobs requiring no qualification, or c) has parents with a lower secondary level of education or less.

Other independent variables include gender (1 = female), education of parents (1 = university education, 0 = below university education), parental social class (0 – unqualified or no job, 1 – qualified workers, 2 – professionals, managers and senior officials), number of books at home, language spoken at home (dummy variable with the value 1 for students who never speak the language of the test at home), Romani language spoken by child or parents (yes = 1) and the number of years in pre-school. These are all standard independent variables frequently used in analyses of school performance (Feniger et al. 2021; Scheeren 2022; Teltemann – Schunck 2016). We also include the early literacy and numeracy index (school readiness), which is based on information provided by the parents on tasks the child was able to accomplish prior to attending school.

Our models also include four school level variables: Size of municipality, type of settlement, size of school (derived from the number of classrooms included in the sample). Additionally, we include being an ethnic minority school with Hungarian language as the language of instructions as a control variable, as Hungarian minority schools are generally smaller and were sampled as a separate strata.

While official TIMSS documentation reports no significant difference in the fourth-grade mathematics and science scores between regular and bridge TIMSS 2019 (von Davier et al. 2020: 13.10), to account for potential mode effects, we include a dummy variable to distinguish the mode of the TIMSS survey.

Modeling strategy and robustness check

To model proficiency in mathematics and science we use a set of three-level hierarchical linear regressions with random intercepts respecting the clustering of students into classes and schools. The regression models are calculated without weights from the TIMSS dataset. However, to account for the omission of weights and to avoid potential biases related to the stratified selection of school we use the parameters used in the sampling of schools (size, language of instruction) as independent variables. As our dependent variables are two sets of five plausible values (mathematics and science scores), we run each regression five times for each of the plausible values and present the average regression coefficients. We apply this modeling strategy as we are not able to rely on tools designed specifically for working with plausible values and weights in the TIMSS survey (such as the International Database (IDB) Analyzer or the EdSurvey R Package) as they are unable to accommodate our three-level hierarchical design combing data from the two modes of TIMSS 2019.

To assess the effect of visiting a low-track class, besides hierarchical linear regression, we use propensity scores matching to compare students from low-track classes with nearly identical students from untracked and high-track classes. This also serves as a robustness check of the former approach. Later, school-level models are estimated to demonstrate that the overall results of schools with tracked classes indicate a lower proficiency in the TIMSS assessment.

Table 1: **Descriptive statistics**

	Mean	SD	Share (%)	Min	Max	Missing (%)
Proficiency in Mathematics	510.426	76.021		160.120	750.600	0.0 %
Proficiency in Science	521.553	81.691		138.032	758.278	0.0 %
Gender (1 = Female)	-	-	49.2	0	1	0.0 %
Parents' highest education (1 = university)	-	-	41.1	0	1	3.9 %
Parents' highest social class (0 = unqualified or no job / 2 = Professionals and managers)	-	-	17.4 / 30.6	0	2	6.3 %
prRoma language (1 = parent or child uses Roma language)	-	-	5.6	0	1	0.0 %
Language of test at home (1 = always other language at home)	-	-	2.7	0	1	0.9 %
Books at home (1 = 0 to 10; 5 – more than 200)	2.895	1.162		1	5	1.0 %
Years in preschool	2.629	0.801		0	3	4.5 %
Early literacy and numeracy (1 = Very well / 3 = Not well)	-	-	7.1 / 48.5	1	3	3.4 %
Tracking identified via Roma language (1 = low-track class)	-	-	1.6	0	1	0.0 %
Tracking identified via parental education (1 = low-track class)	-	-	1.4	0	1	0.0 %
Tracking identified via parental occupation (1 = low-track class)	-	-	1.7	0	1	0.0 %
Language of instruction (1 = Hungarian)	-	-	4.6	0	1	0.0 %
Size of municipality (2 = 100 – 500 thousand; 7 = 3000 or fewer)	5.001	1.660		2	7	1.5 %
Area in which school is located (1 = Urban; 4 = Small town or village)	2.926	1.280		1	4	1.5 %
School size (0 = small; 2 = large)	0.925	0.476		0	2	0.0 %

Source: TIMSS 2019

Analysis

Descriptive statistics

The basic descriptive characteristic of our sample is provided in Table 1. We see that we identified between 1.4 and 1.7% of students in a low-track classes in ethnically and socioeconomically diverse schools visited by children with very low socioeconomic status or Roma ethnicity. As we do not have all classes from the schools included in the sample, we are likely not identifying all tracked classes as the sample might miss the tracked class.

As we can see, the variables have a rather small share of missing values, we therefore do not employ imputation techniques in our multivariate analyses. The school-background questionnaire for two schools does not include

information on the area where the school is located and size of municipality, which means that the final number of schools included in the analysis is 201. Moreover, this omission reduces the number of students in low-track classes identified by employment of parents as one of these classes was in a school with missing information on the area and municipality size.

Hierarchical Linear Regression

The results of our hierarchical linear models modeling proficiency scores in mathematics and science are reported in tables 2 and 3. With regard to the independent variables, we see significant differences between girls and boys, students with parents with university education and without it, as well as difference connected to the social class of the parents.

Interestingly, speaking Romani language, or speaking other than the language of the test at home has a stronger negative effect for science results. On the other hand, the early literacy and numeracy index (i.e., school readiness) is a stronger predictor of performance in mathematics than in science. Similarly, gender differences are more than double in size in mathematics. The effect of other variables is approximately similar for both dependent variables across models 1 and 3 in Tables 2 and 3.

Also, taking the TIMSS exam using the paper questionnaire has no effect on mathematics results, but it seems to have a negative impact (even though only at the 0.05 significance level) on the science results. While this is an interesting finding unnoticed by the TIMSS documentation, it is beyond the scope of our paper.

Models in Tables 2 and 3 agree also on the non-significance of the school-level variables included in the model. Overall, the explanatory power of models in Table 3 is slightly higher mostly due to the stronger connection between Romani language or speaking other than the language of the test at home and proficiency scores in science.

Regarding our three main explanatory variables, the results in Tables 2 and 3 seem to provide a robust support for the hypothesis on strong negative impacts of early tracking in ethnically and socioeconomically diverse schools with a relevant share of children with very low socioeconomic status or Roma ethnicity on students from low-track classes. All three methods of identifying a low-track class result in creating a dummy variable which predicts a relatively drastic decrease in proficiency scores both in mathematics as well as in science. This decrease seems to be of equal magnitude for mathematics and science. Being in the low-track classes identified via Romani language is the strongest predictor of a low score. At a scale internationally standardized to an average of 500 and a standard deviation of 100, going to such a class lowers the proficiency scores by more than 84 score points making it the strongest effect

size in all the models. Overall, the effect of tracking identified based on parental occupation is the weakest with the effect of tracking identified based on parental education being only slightly stronger. We discuss this difference in the conclusion.

Robustness check

As an alternative to the hierarchical linear regression approach, we used propensity score matching to estimate the average marginal effect of being in a low-track class identified by one of the three methods. We were able to perform exact matching using all independent variables from our models which had a significant coefficient (gender, parent's highest education, parent's highest social class, Romani language, language of test at home, books at home, years in preschool, early literacy and numeracy). Comparison of the matched sample with the treated classes confirms a strong association between visiting a low-track class in an ethnically and socioeconomically diverse school with children with very low socioeconomic status or Roma ethnicity and academic performance in mathematics and sciences in the TIMSS assessment corroborating the results of our multilevel models in Tables 2 and 3.

To account for the alternative explanation of the observed effect of tracking as being simply the result of a meritocratic selection of low-performing students into low tracks, we also estimated a series of school-level models. With these models, we try to explain the average school performance in mathematics and science. The models in Tables A and B in the Appendix show that accounting for socioeconomic and ethnic composition of the school, the presence of tracking practices significantly lowers the average proficiency in mathematics and science of the school. This finding holds for all three methods used to identify tracking and suggests that the poor results of students from the tracked classes are strong enough to significantly lower the average performance of the whole school. This demonstrates that the effects observed in the hierarchical regression models and in the matching approach are not merely a result of assigning already low-performing students into low tracks. (If this were the case, the overall results of schools with tracked classes should not be different from schools without tracking.) Moreover, if models in Tables A and B are calculated without students in low tracks[14], the difference between schools with and without tracking practices becomes either non-significant or notably smaller. This suggest that while some schools with tracking practices may also be of lower quality in general, their low performance is in most cases primarily due to the poor results of the low tracks.

[14] In these models, the average school performance of schools with tracking practices is calculated only for students not assigned to the low-track class. These models are available upon request form the authors.

Table 2: **Proficiency in mathematics, hierarchical linear regression**

	Model 1		Model 2		Model 3	
	B	p	B	p	B	p
(Intercept)	526.337	**<0.001**	527.137	**<0.001**	527.422	**<0.001**
Gender (1 = Female)	-12.054	**<0.001**	-11.847	**<0.001**	-11.786	**<0.001**
Parents' highest education (1 = university)	20.625	**<0.001**	20.591	**<0.001**	20.391	**<0.001**
Parents' highest social class: Qualified workers (ref.)						
Parents' highest social class: Unqualified or no job	-12.891	**<0.001**	-12.624	**<0.001**	-12.677	**<0.001**
Parents' highest social class: Professionals and managers	4.194	0.058	4.141	0.062	4.020	0.069
Roma language (1 = parent or child uses Roma language)	-29.057	**<0.001**	-33.194	**<0.001**	-33.785	**<0.001**
Language (1 = always other language at home)	-22.229	**0.002**	-22.644	**0.001**	-22.344	**0.002**
Books at home (1 to 5)	11.604	**<0.001**	11.610	**<0.001**	11.661	**<0.001**
Years in preschool	9.120	**<0.001**	9.097	**<0.001**	9.322	**<0.001**
Early Literacy and Numeracy: Not well (ref.)						
Early Literacy and Numeracy: Moderately well	17.655	**<0.001**	17.472	**<0.001**	17.459	**<0.001**
Early Literacy and Numeracy: Very well	42.161	**<0.001**	42.125	**<0.001**	42.014	**<0.001**
Class level variables						
Tracking: Roma language (1 = low-track class)	-85.661	**<0.001**				
Tracking: parental education (1 = low-track class)			-56.715	**<0.001**		
Tracking: parental occupation (1 = low-track class)					-36.476	**<0.001**
Mode od TIMSS 2019 survey (1 = bridge version)	-6.466	0.199	-7.991	0.108	-7.338	0.148
School level variables						
Language of instruction (1 = Hungarian)	5.815	0.532	6.510	0.482	4.013	0.668
Size of municipality (2 to 7)	-4.044	0.095	-4.155	0.081	-4.082	0.094
Area in which school is located: Urban–densely populated (ref.)						
Area in which school is located: Suburban	0.913	0.878	0.769	0.883	0.410	0.902
Area in which school is located: Medium size city or large town	1.940	0.808	2.819	0.719	2.743	0.733
Area in which school is located: Small town or village	-1.320	0.870	-1.623	0.853	-2.851	0.762
School size: Middle sized school (ref.)						
School size: Small	0.355	0.838	1.342	0.757	1.932	0.702
School size: Large	4.751	0.514	2.865	0.699	4.496	0.548
Random Effects						
σ^2	2839.87		2846.45		2847.46	
τ_{00}	281.06 $_{IDCLASS}$		334.17 $_{IDCLASS}$		315.44 $_{IDCLASS}$	
	471.26 $_{IDSCHOOL}$		420.42 $_{IDSCHOOL}$		461.45 $_{IDSCHOOL}$	
ICC	0.21		0.21		0.21	
N	357		357		357	
	201		201		201	
Observations	5250		5250		5250	
Marginal R^2 / Conditional R^2	0.302 / 0.448		0.295 / 0.442		0.293 / 0.445	
AIC	57092.101		57115.347		57119.508	
log-Likelihood	-28523.051		-28534.673		-28536.754	

Note: p – values below 0.05 are marked bold
Source: TIMSS 2019

Table 3: **Proficiency in science, hierarchical linear regression**

	Model 1		**Model 2**		**Model 3**	
	B	p	B	p	B	p
(Intercept)	537.269	**<0.001**	537.869	**<0.001**	538.190	**<0.001**
Gender (1 = Female)	-4.114	**0.017**	-3.873	**<0.001**	-3.798	**0.027**
Parents' highest education (1 = university)	20.674	**<0.001**	20.626	**<0.001**	20.402	**<0.001**
Parents' highest social class: Qualified workers (ref.)						
Parents' highest social class: Unqualified or no job	-15.683	**<0.001**	-15.349	**<0.001**	-15.401	**<0.001**
Parents' highest social class: Professionals and managers	5.971	**0.015**	5.927	**0.016**	5.762	**0.019**
Roma language (1 = parent or child uses Roma language)	-53.445	**<0.001**	-58.208	**<0.001**	-58.929	**<0.001**
Language (1 = always other language at home)	-32.062	**<0.001**	-32.516	**<0.001**	-32.175	**<0.001**
Books at home (1 to 5)	12.547	**<0.001**	12.552	**<0.001**	12.614	**<0.001**
Years in preschool	8.903	**<0.001**	8.855	**<0.001**	9.113	**<0.001**
Early Literacy and Numeracy: Not well (ref.)						
Early Literacy and Numeracy: Moderately well	13.756	**<0.001**	13.557	**<0.001**	13.524	**<0.001**
Early Literacy and Numeracy: Very well	29.141	**<0.001**	29.124	**<0.001**	28.984	**<0.001**
Class level variables						
Tracking: Roma language (1 = low-track class)	-84.429	**<0.001**				
Tracking: parental education (1 = low-track class)			-56.163	**<0.001**		
Tracking: parental occupation (1 = low-track class)					-37.606	**<0.001**
Mode od TIMSS 2019 survey (1 = bridge version)	-10.355	**0.037**	-11.853	**0.016**	-11.188	**0.024**
School level variables						
Language of instruction (1 = Hungarian)	-4.832	0.609	-4.212	0.648	-6.427	0.497
Size of municipality (2 to 7)	-3.465	0.153	-3.537	0.141	-3.452	0.153
Area in which school is located: Urban–densely populated (ref.)						
Area in which school is located: Suburban	2.836	0.768	2.779	0.770	2.247	0.815
Area in which school is located: Medium size city or large town	1.368	0.815	2.173	0.767	2.091	0.772
Area in which school is located: Small town or village	-2.528	0.792	-2.782	0.768	-4.014	0.671
School size: Middle sized school (ref.)						
School size: Small	-1.974	0.683	-1.060	0.751	-0.605	0.764
School size: Large	5.511	0.440	3.957	0.586	5.626	0.438
Random Effects						
σ^2	3087.10		3096.74		3097.86	
τ_{00}	199.57 $_{IDCLASS}$		230.02 $_{IDCLASS}$		224.89 $_{IDCLASS}$	
	495.96 $_{IDSCHOOL}$		466.42 $_{IDSCHOOL}$		478.36 $_{IDSCHOOL}$	
ICC	0.18		0.18		0.18	
N	357		357		357	
	201		201		201	
Observations	5250		5250		5250	
Marginal R^2 / Conditional R^2	0.335 / 0.458		0.329 / 0.452		0.328 / 0.453	
AIC	57473.936		57497.901		57500.829	
log-Likelihood	-28713.968		-28725.951		-28727.415	

Note: p – values below 0.05 are marked bold
Source: TIMSS 2019

Conclusion

Our study explored the impact of a particular form of early within-school tracking at elementary schools in Slovakia – an under-studied tracking strategy (Van de Werfhorst – Mijs 2010) which could be described as *informal internal differentiation* within the typology of tracking developed by Blossfeld et al. (2016). Schools in Slovakia employ several strategies to create tracked classes at the beginning or in the course of elementary school, years before the age when the first formal tracking in the Slovak educational system occurs (Hapalová – Vančíková 2019; Kusá 2016). The extremely early introduction of selecting mechanisms already at the time of entry into the schooling system makes this form of tracking particularly study-worthy, as such an early tracking may have extremely pronounced effects on educational and career outcomes of the students (Scheeren 2022).

Our focus is on the effect of these informal tracking practices in ethnically and socioeconomically diverse schools with a relevant number of children with parents with very low socioeconomic status or Roma ethnicity on the low-track student proficiency in mathematics and science measured by the TIMSS 2019 survey of fourth grade students. While the survey does not provide any information on within-school tracking, it samples up to four compact classes per school enabling to identify extremely diverging distributions of parental socio-demographic parameters between fourth-grade classes. We see their occurrence as an indication that the school does not use random assignment of students into classes but most likely relies on some form of sorting mechanism. As the impact of socio-economic disadvantages pre-dates the school entry (Bradbury et al. 2015), we assume that students from less-privileged backgrounds will perform worse in any kind of tests or entrance exams. This will lead to the creation of homogeneous low-track classes. By studying the distribution of parental education, type of work and the use of Romani language by students and their parents, we are able to identify several schools which have a tracked class with children from a disadvantaged background and/or of Roma ethnicity. As the sample does not include all classes from schools included in the sample, our identification strategy most likely underestimates the share of schools employing tracking practices in the early classes of the elementary schools.

After identifying low-track classes in ethnically and socioeconomically diverse schools visited by children with very low socioeconomic status or Roma ethnicity, we use a series of hierarchical linear models to establish if studying in a low-track class has an impact on proficiency scores in mathematics and science. The results confirm a clearly significant effect of being in a low-track class on performance in the TIMSS assessment. Of the three

identification criteria used to establish low-track classes, the criteria relying on Romani language in the household of the student identified the most significantly underperforming classes. Students from such classes had test scores lower by more than 84 score points on an internationally standardized scale with an average of 500 and a standard deviation of 100 in both mathematics and science. This was the strongest effect in our models, which included all relevant socio-demographic variables related to school performance. A score difference of 84 points is also one of the largest reported by analyses based on the TIMSS dataset. We confirmed the robustness of our results in a simultaneous approach based on propensity scores. The particularly strong effect of our treatment variables might be in part due to our identification strategy of low-track classes in an extremely diverse socio-economic background. By focusing on particularly strong indices of socio-economic disadvantage, we missed tracking in more homogeneous socio-economic environments which might have overall a lower impact on the test scores.

For a long time, researchers and analysts have reported informal tracking practices resulting in segregation of Roma students at elementary schools in Slovakia (Huttová et al. 2012; Kusá 2016; Rafael ed. 2011). Our study provides an innovative analytical approach to one of the standard international assessment programs to identify those practices and to explore their impact on school performance of the students. According to our findings, students from low-track classes in ethnically and socioeconomically diverse schools visited by children with very low socioeconomic status or Roma ethnicity perform notably worse when compared with children with identical socio-economic backgrounds and pre-school experience. Our results imply the importance of including tracking practices in the ongoing desegregation discussion in Slovakia and in the wider central-European region.

Our study suggests that almost two percent of the elementary schools´ students in Slovakia visit informal low-track classes in ethnically and socioeconomically diverse schools visited by children with very low socioeconomic status or Roma ethnicity. Children in such classes have far worse educational results than similar children visiting untracked classes. Moreover, some of our results suggest that tracking practices can be a sign of low quality of education provided by the school in general. Further analyses should establish the exact extent of the phenomenon and explore if the identification of tracking used by our paper can be used to identify early informal within-school tracking in other countries covered by the TIMSS assessment. The particularly strong effect observed should motivate further research into early *informal internal* tracking which remains largely unnoticed by the large-scale assessments. Our empirical identification of tracking based on parental characteristics opens an avenue to further analyses in this area. On the other hand, our reliance on cross-sectional

data limits the claims that can be made about the causal link between tracking and proficiency in the TIMSS assessment. Dedicated longitudinal data are necessary to confirm the causal nature of the link between being assigned to a low-track and poor performance.

Conflict of interest
The authors declare no conflict of interest.

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REFERENCES

AMMERMÜLLER, A., 2005: Educational Opportunities and the Role of Institutions. ZEW-Centre for European Economic Research Discussion Paper 05-044. DOI: http://dx.doi.org/10.2139/ssrn.753366

BEDNARIK, M. – HIDAS, S. – MACHLICA, G., 2019: Enhancing the Social Integration of Roma in Slovak Republic. OECD Economics Department Working Papers 1551. DOI: https://doi.org/10.1787/197eb309-en

BETTS, J. R., 2011: The Economics of Tracking in Education. In Handbook of the Economics of Education Vol. 3 (pp. 341-381). Elsevier. DOI: https://doi.org/10.1016/B978-0-444-53429-3.00007-7

BLOSSFELD, H. P. – BUCHHOLZ, S. – SKOPEK, J. – TRIVENTI, M. (Eds.), 2016: Models of Secondary Education and Social Inequality: An International Comparison. Edward Elgar Publishing.

BOL, T. – VAN DE WERFHORST, H. G., 2013: The Measurement of Tracking, Vocational Orientation, and Standardization of Educational Systems: A Comparative Approach. AIAS: GINI Discussion Paper 81.

BOL, T. – WITSCHGE, J. – VAN DE WERFHORST, H. G. – DRONKERS, J., 2014: Curricular Tracking and Central Examinations: Counterbalancing the Impact of Social Background on Student Achievement in 36 Countries. Social Forces 92(4): 1545-1572. DOI: https://doi.org/10.1093/sf/sou003

BRADBURY, B. – CORAK, M. – WALDFOGEL, J. – WASHBROOK, E., 2015: Too Many Children Left Behind: The US Achievement Gap in Comparative Perspective. Russell Sage Foundation.

BRUNELLO, G. – CHECCHI, D., 2007: Does School Tracking Affect Equality of Opportunity? New International Evidence. Economic policy 22(52): 782-861. DOI: https://doi.org/10.1111/j.1468-0327.2007.00189.x

CRUL, M. – HOLDAWAY, J., 2009: Children of Immigrants in Schools in New York and Amsterdam: The Factors Shaping Attainment. Teachers College Record 111(6): 1476-1507.

VON DAVIER, M. – FOY, P. – MARTIN, M. O. – MULLIS, I. V. S., 2020: Examining eTIMSS Country Differences Between eTIMSS Data and Bridge Data: A look at Country-level Mode of Administration Effects. In Martin, M. O., von Davier, M., Mullis, I. V. S. (Eds.): Methods and Procedures: TIMSS 2019 Technical Report (pp. 13.1-13.24). International Association for the Evaluation of Educational Achievement (IEA). DOI: https://timssandpirls.bc.edu/timss2019/methods/chapter-13.html

DIPRETE, T. – EIRICH, G. M., 2006: Cumulative Advantage as a Mechanism for Inequality: A Review of Theoretical and Empirical Developments. Annual Review of Sociology 32: 271-297.

DUNCAN, O. D. – DUNCAN, B., 1955: A Methodological Analysis of Segregation Indexes. American Sociological Review 20(2): 210-217. DOI: https://doi.org/10.2307/2088328

DUPRIEZ, V. – DUMAY, X. – VAUSE, A., 2008: How do School Systems Manage Pupils' Heterogeneity?. Comparative Education Review 52(2): 245-273. DOI: https://doi.org/10.1086/528764

DURU-BELLAT, M. – SUCHAUT, B., 2005: Organisation and Context, Efficiency and Equity of Educational Systems: What PISA Tells us. European Educational Research Journal 4(3): 181-194. DOI: https://doi.org/10.2304/eerj.2005.4.3.3

EDUCATION ACT, NO. 245/2008 COLL. ON EDUCATION AND TRAINING, 2008: https://www.slov-lex.sk/pravne-predpisy/SK/ZZ/2008/245/20210901.html/

ENTORF, H. – LAUK, M., 2008: Peer Effects, Social Multipliers and Migrants at School: An International Comparison. Journal of Ethnic and Migration Studies 34(4): 633-654. DOI: https://doi.org/10.2139/ssrn.908844

EUROPEAN COMMISSION, 2023 (April 19): The European Commission Decides to Refer SLOVAKIA to the Court of Justice of the European Union for not Sufficiently Addressing Discrimination Against Roma Children at School. https://ec.europa.eu/commission/presscorner/detail/en/ip_23_2249

FENIGER, Y. – BAR-HAIM, E. – BLANK, C., 2021: From Social Origin to Selective High School Courses: Ability Grouping as a Mechanism of Securing Social

Advantage in Israeli Secondary Education. Research in Social Stratification and Mobility 76: 100627. DOI: https://doi.org/10.1016/j.rssm.2021.100627

FIGLIO, D. N. – PAGE, M. E., 2002: School Choice and the Distributional Effects of Ability Tracking: Does Separation Increase Inequality?. Journal of Urban Economics 51(3): 497-514. DOI: https://doi.org/10.1006/juec.2001.2255

FLEISCHMANN, M. – HÜBNER, N. – NAGENGAST, B. – TRAUTWEIN, U., 2023: The Dark Side of Detracking: Mixed-ability Classrooms Negatively Affect the Academic Self-concept of Students with Low Academic achievement. Learning and Instruction 86: 101753. DOI: https://doi.org/10.1016/j.learninstruc.2023.101753

FRIEDMAN, E. – SURDU, M. – KRIGLEROVÁ, E. G. – KUBÁNOVÁ, M. – SLOSIARIK, M., 2009: School as Ghetto: Systemic Overrepresentation of Roma in Special Education in Slovakia. Roma Education Fund.

GAMORAN, A. – BERENDS, M., 1987: The Effects of Stratification in Secondary Schools: Synthesis of Survey and Ethnographic Research. Review of Educational Research 57(4): 415-435. DOI: https://doi.org/10.3102/00346543057004415

GAMORAN, A. – MARE, R. D., 1989: Secondary School Tracking and Educational Inequality: Compensation, Reinforcement, or Neutrality?. American Journal of Sociology 94(5): 1146-1183.

GAMORAN, A. – NYSTRAND, M. – BERENDS, M. – LEPORE, P. C., 1995: An Organizational Analysis of the Effects of Ability Grouping. American Educational Research Journal 32(4): 687-715. DOI: https://doi.org/10.3102/00028312032004687

GDOVINOVÁ, D., 2018 (November 17). Integrácia po slovensky: Veselé a segregované deti. týždeň. https://www.tyzden.sk/spolocnost/51728/vesele-a-segregovane-deti/

HALLINAN, M. T., 1988: Equality of Educational Opportunity. Annual Review of Sociology 14(1): 249-268. DOI: https://doi.org/10.1146/annurev.so.14.080188.001341

HALLINAN, M. T., 1994: Tracking: From Theory to Practice. Sociology of Education 67(2): 79-84. DOI: https://doi.org/10.2307/2112697

HALLINAN, M. T., 1996: Race Effects on Students' Track Mobility in High School. Social Psychology of Education 1(1): 1-24. https://doi.org/10.1007/BF02333403

HALLINAN, M. T. – KUBITSCHEK, W. N., 1999: Curriculum Differentiation and High School Achievement. Social Psychology of Education 3(1): 41-62. DOI: https://doi.org/10.1023/A:1009603706414

HANUSHEK, E. A. – WOESSMANN, L., 2006: Does Early Tracking Affect Educational Inequality and Performance? Differences-in-differences Evidence Across Countries. Economic Journal 116(510): C63-C76.

HAPALOVÁ, M., 2019: Segregácia rómskych detí. In Hall, R., Dráľ, P., Fridrichová, P., Hapalová, M., Lukáč, S., Miškolci, J., Vančíková, K.: Analýza zistení o stave školstva na Slovensku: To dá rozum (pp. 1.2.5.). Mesa 10. https://analyza.todarozum.sk/docs/320420001yw1a/

HAPALOVÁ, M. – HVOZDOVIČ, Ľ., 2013: Analýza školských vzdelávacích programov vo vzťahu k rómskym žiakom zo sociálne znevýhodneného prostredia. In Petrasová, A., Pavlov, I., Porubský, Š., Hvozdovič, Ľ., Revészová, Z., Štefanko, I., Rafael, V., Hapalová, M., Irály Csajka, L., Motlová, J.: Výskum školských vzdelávacích programov a pedagogickej praxe na školách s vysokým zastúpením žiakov zo sociálne znevýhodneného prostredia so zameraním na princípy inkluzívneho vzdelávania (pp. 7-43). Iuventa, MŠVVŠ SR. https://www.vyskummladeze.sk/wp-content/uploads/2021/07/vyskum_svvp.pdf

HAPALOVÁ, M. – VANČÍKOVÁ, K., 2019: Oddelené vzdelávanie detí s nadaním. In Hall, R., Dráľ, P., Fridrichová, P., Hapalová, M., Lukáč, S., Miškolci, J., Vančíková, K.: Analýza zistení o stave školstva na Slovensku: To dá rozum (pp. 1.2.6.). Mesa 10. DOI: https://analyza.todarozum.sk/docs/320410002si0a/

HERRERA SOSA, K. M. – GORTAZAR, L. – AMOROSO, J. M. – BODEWIG, CH. – KARACSONY, S. I. – MORENO VIGO, J. M., 2015: Slovak Republic - Skilling up the Next Generation: an Analysis of Slovak Republic's Performance in the Program for International Student Assessment (English). World Bank Group. http://documents.worldbank.org/curated/en/329961467987873147/Slovak-Republic-Skilling-up-the-next-generation-an-analysis-of-Slovak-Republic-s-performance-in-the-program-for-international-student-assessment

HORN, D., 2009: Age of Selection Counts: A Cross-country Analysis of Educational Institutions. Educational Research and Evaluation 15(4): 343-366. DOI: https://doi.org/10.1080/13803610903087011

HUANG, M. H., 2009: Classroom Homogeneity and the Distribution of Student Math Performance: A country-level Fixed-effects Analysis. Social Science Research 38(4): 781-791. DOI: https://doi.org/10.1016/j.ssresearch.2009.05.001

HUTTOVÁ, J. – GYÁRFÁŠOVÁ, O. – SEKULOVÁ, M., 2012: Segregácia alebo inklúzia Rómov vo vzdelávaní: Voľba pre školy. Nadácia otvorenej spoločnosti.

KERCKHOFF, A. C., 1995: Institutional Arrangements and Stratification Processes in Industrial Societies. Annual review of sociology 21(1): 323-347. DOI: https://doi.org/10.1146/annurev.so.21.080195.001543

KRIGLEROVÁ, E. G. (Ed.), 2015: Kľukaté cesty k inkluzívnemu vzdelávaniu na Slovensku. CVEK.

KUSÁ, Z., 2016: Škola nie je pre všetkých. Sociologický ústav SAV.

LAJČÁKOVÁ, J. – RAFAEL, V. – ZÁLEŠÁK, M. – MIŠKOLCI, J. – PETRASOVÁ, A., 2017: Školy proti segregácii. Metodická príručka na prevenciu a odstraňovanie segregácie rómskych žiakov. OZ EduRoma – Roma Education Project.

LAROCHE, S. – FOY, P., 2020: Chapter 9: Sample implementation in TIMSS 2019. In M. O. Martin, M. O., von Davier, M., Mullis, I. V. S. (Eds.): Methods and procedures: TIMSS 2019 technical report (pp. 9.1-9.261). International Association for the Evaluation of Educational Achievement (IEA). https://timssandpirls.bc.edu/timss2019/methods/chapter-9.html

LAVRIJSEN, J., 2013: Characteristics of Educational Systems: How They Influence Outcomes in the Short and the Long Run. Research Paper SSL/2012.04/1.1.1.

MARKS, G. N., 2005: Cross-national Differences and Accounting for Social Class Inequalities in Education. International sociology 20(4): 483-505. DOI: https://doi.org/10.1177/0268580905058328

MICKLEWRIGHT, J. – SCHNEPF, S. V., 2006: Inequality of Learning in Industrialised Countries. IZA Discussion Papers 2517. DOI: https://dx.doi.org/10.2139/ssrn.956383

OAKES, J., 1990: Chapter 3: Opportunities, Achievement, and Choice: Women and Minority Students in Science and Mathematics. Review of Research in Education 16(1): 153-222. DOI: https://doi.org/10.3102/0091732X016001153

OAKES, J., 2005: Keeping Track: How Schools Structure Inequality. Yale University Press.

OECD, 2010: PISA 2009 Results: Overcoming Social Background - Equity in Learning Opportunities and Outcomes (Volume II). DOI: http://dx.doi.org/10.1787/9789264091504-en

OECD, 2014: When is Competition Between Schools Beneficial? PISA in Focus No. 42. DOI: https://doi.org/10.1787/5jz0v4zzbcmv-en

OECD, 2020: PISA 2018 Results: Effective Policies, Successful Schools (Volume V). DOI: https://doi.org/10.1787/ca768d40-en

RAFAEL, V. (Ed.), 2011: Odpovede na otázky (de)segregácie rómskych žiakov vo vzdelávacom systéme na Slovensku. Nadácia otvorenej spoločnosti – Open Society Foundation.

SCHEEREN, L., 2022: The Differential Impact of Educational Tracking on SES Gaps in Educational Achievement for Boys and Girls. European Sociological Review 38(6): 942-958. https://doi.org/10.1093/esr/jcac012

SCHÜTZ, G. – URSPRUNG, H. W. – WÖßMANN, L., 2008: Education Policy and Equality of Opportunity. Kyklos 61(2): 279-308. DOI: https://doi.org/10.1111/j.1467-6435.2008.00402.x

SHAVIT, Y. – MÜLLER, W., 1998: From School to Work: A Comparative Study of Educational Qualifications and Occupational Destinations. Oxford University Press.

SKOPEK J. – TRIVENTI M. – BUCHHOLZ, S., 2019: How do Educational Systems Affect Social Inequality of Educational Opportunities? The Role of Tracking in Comparative Perspective. In Becker, R. (Ed.): Research Handbook on the Sociology of Education (pp. 214–232). Edward Elgar Publishing.

STRELLO, A. – STRIETHOLT, R. – STEINMANN, I. – SIEPMANN, C., 2021: Early Tracking and Different Types of Inequalities in Achievement: Difference-in-differences Evidence from 20 Years of Large-scale Assessments. Educational Assessment, Evaluation and Accountability 33(1): 139-167. DOI: https://doi.org/10.1007/s11092-020-09346-4

STRELLO, A. – STRIETHOLT, R. – STEINMANN, I., 2022: Does Tracking Increase Segregation? International Evidence on the Effects of Between-school Tracking on Social Segregation Across Schools. Research in Social Stratification and Mobility 78(5): 100689. DOI: https://doi.org/10.1016/j.rssm.2022.100689

SVOBODA, Z., 2013: Inkluzívne vzdelávanie. In Hapalová, M, Kriglerová, E.G. (eds.): O krok bližšie k inklúzii (pp. 7-20). Člověk v tísni-pobočka Slovensko, Centrum pre výskum etnicity a kultúry.

TELTEMANN, J. – SCHUNCK, R., 2016: Education Systems, School Segregation, and Second-generation Immigrants' Educational Success: Evidence from a Country-fixed Effects Approach Using Three Waves of PISA. International Journal of Comparative Sociology 57(6): 401-424. DOI: https://doi.org/10.1177/0020715216687348

VAN DE WERFHORST, H. G. – MIJS, J. J., 2010: Achievement Inequality and the Institutional Structure of Educational Systems: A Comparative Perspective. Annual review of sociology 36: 407-428. DOI: https://doi.org/10.1146/annurev.soc.012809.102538

VANČÍKOVÁ, K., 2019a: Priskorá diferenciácia vzdelávacích dráh. In Hall, R., Dráľ, P., Fridrichová, P., Hapalová, M., Lukáč, S., Miškolci, J., Vančíková, K.: Analýza zistení o stave školstva na Slovensku: To dá rozum (pp. 4.3.1.). Mesa 10. https://analyza.todarozum.sk/docs/326561002cw0a/

VANČÍKOVÁ, K., 2019b: Nejednotné prijímanie prvákov. In Hall, R., Dráľ, P., Fridrichová, P., Hapalová, M., Lukáč, S., Miškolci, J., Vančíková, K.: Analýza zistení o stave školstva na Slovensku: To dá rozum (pp. 4.2.3.). Mesa 10. https://analyza.todarozum.sk/docs/348321001wx1a/

VANČÍKOVÁ, K., 2019c: Deti zo SZP a nulté ročníky. In Hall, R., Dráľ, P., Fridrichová, P., Hapalová, M., Lukáč, S., Miškolci, J., Vančíková, K.: Analýza zistení o stave školstva na Slovensku: To dá rozum (pp. 4.2.1.2.). Mesa 10. https://analyza.todarozum.sk/docs/348247001ly1a/

VESELÝ, A. – MATĚJŮ, P., 2010: Vzdělávací systémy a reprodukce vzdělanostních nerovností. In Matějů, P., Straková, J., Veselý, A., Basl, J.: Nerovnosti ve vzdělávání: Od měření k řešení (pp. 38-90). Sociologické nakladatelství (SLON).

WOESSMANN, L., 2009: International Evidence on School Tracking: A review. CESifo DICE Report 7(1): 26-34.

ZIMENOVÁ, Z., 2013: Pripravenosť slovenského vzdelávacieho systému na realizáciu inklúzie. In Hapalová, M., Kriglerová, E.G. (eds.): O krok bližšie k inklúzii (pp. 31-57). Člověk v tísni-pobočka Slovensko, Centrum pre výskum etnicity a kultúry.

Appendix

Table A: **Proficiency in mathematics, school-level model, linear regression**

	Model 1		Model 2		Model 3	
	B	p	B	p	B	p
(Intercept)	257.46	**<0.001**	250.68	**<0.001**	239.86	**<0.001**
Share of parents with university education	74.92	**<0.001**	77.63	**<0.001**	73.74	**<0.001**
Social class of parents	-16.56	0.171	-13.00	0.276	-15.46	0.203
Share of Roma language	-46.83	**0.023**	-59.44	**0.004**	-58.18	**0.006**
Share of other language spoken at home	53.40	**0.041**	55.09	**0.032**	61.22	**0.020**
Books at home (1 to 5)	27.98	**<0.001**	25.29	**0.001**	28.44	**<0.001**
Years in preschool	-3.14	0.686	-4.57	0.549	-3.11	0.690
Early literacy and numeracy	22.69	0.101	25.77	0.055	26.35	0.055
Tracking: Roma language (1 = yes)	-45.16	**0.004**				
Tracking: parental education (1 = yes)			-59.57	**<0.001**		
Tracking: parental occupation (1= yes)					-31.04	**0.007**
Observations	203		203		203	
R^2 / R^2 adjusted	0.582 / 0.564		0.596 / 0.580		0.580 / 0.562	

Note: p – values below 0.05 are marked bold
Source: TIMSS 2019

Table B: **Proficiency in science, school-level model, linear regression**

	Model 1		Model 2		Model 3	
	B	p	B	p	B	p
(Intercept)	333.15	**<0.001**	320.71	**<0.001**	312.10	**<0.001**
Share of parents with university education	80.46	**<0.001**	83.49	**<0.001**	79.26	**<0.001**
Social class of parents	-17.76	0.103	-14.53	0.179	-16.59	0.131
Share of Roma language	-67.14	**<0.001**	-79.77	**<0.001**	-79.86	**<0.001**
Share of other language spoken at home	1.04	0.964	2.62	0.910	9.72	0.681
Books at home (1 to 5)	27.44	**<0.001**	24.89	**<0.001**	27.97	**<0.001**
Years in preschool	0.38	0.956	-0.30	0.965	0.60	0.932
Early literacy and numeracy	13.00	0.296	17.49	0.150	17.45	0.158
Tracking: Roma language (1 = yes)	-52.40	**<0.001**				
Tracking: parental education (1 = yes)			-57.66	**<0.001**		
Tracking: parental occupation (1= yes)					-34.49	**0.001**
Observations	203		203		203	
R^2 / R^2 adjusted	0.716 / 0.704		0.722 / 0.710		0.713 / 0.701	

Note: p – values below 0.05 are marked bold
Source: TIMSS 2019