SCHOOL QUALITY AND EQUITY
IN CENTRAL AND EASTERN EUROPE

TRACKING AND INEQUALITY OF LEARNING OUTCOMES IN HUNGARIAN SECONDARY SCHOOLS

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Findings from the recent OECD PISA studies highlight the need for the Hungarian school system to improve both effectiveness and equality. Hungarian 15-year-old students scored

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somewhat below or around the OECD average in the areas of reading, mathematical, and scientific literacy. In addition, students differ less in academic achievement within the school than they do among different schools, a finding echoed in the analysis of national student assessment data covering the sixth, eighth and tenth grades (Balázsi et al., 2005; Balázsi & Zempléni, 2004). While the achievement gaps among schools put the Hungarian system as one of the most unequal among forty-some countries participating in the PISA studies, such gaps seem to largely mirror the differences in socio-economic backgrounds of students (OECD, 2001; 2004).

In this paper we further explore the issue of equality of learning outcomes in Hungary by examining the effects of tracking in secondary schools. On the basis of analyzing the PISA 2003 data, we show that the dramatic disparities in students' learning outcomes exist among different tracks which, to a great extent, can be explained by a measure of the socio-economic status (SES) of students' family background, as well as the aggregate SES characteristics of student intake at the school level. We find that, while high-SES schools overall have higher levels of test scores, they also tend to have better resources. Moreover we suggest that this system not only makes high inequality but its "low end" vocational training schools put forward a not-so-bright future as the effectiveness issue is concerned.

Tracking, school choice, and educational inequality

Tracking, or streaming, refers to the practice of placing students in different classes or curricular programmes based on perceived differences in their abilities or interests. According to economic theory, more choice by parents and students can put competitive pressure on schools to be more effective and efficient (Burgess, Propper & Wilson, 2005). However, choice by schools via selection of students, or sorting, can lead to segregation by child quality (Robertson & Symons, 2003). Analysing the Hungarian school choice system, Kertesi & Kézdi (2005) show that sorting leads to an equilibrium of clear systemic level segregation along student performance, which often is also social status-based segregation.

Evidence on the link between tracking and inequality abounds in educational research. Summarizing the literature on tracking and running their own analysis on a large pool of US data, Arum and Shavit (1994) find that curricular tracking does reproduce inequalities, though they argue that some form of vocational education helps disadvantaged students to lower their possibility of being unemployed in the future. A recent OECD report con-

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cludes, on the basis of analyzing PISA 2003 data, that early separation of students into different school types and tracks leads to both greater differences among schools and greater socio-economic disparities in learning outcomes (OECD, 2004).

Evidence of the effects of broader institutional arrangements, including school tracking, on educational outcomes comes from research in other disciplinary areas as well. In a study of the effect of social background on young people's educational outcomes in twelve European countries, Ianelli (2002) found these countries vary in the extent to which parental education affects their children's educational and occupational attainment. While the effects of parental education are quite small in Nordic countries with more universalistic welfare policies, they are relatively large in Eastern European countries. The author argued that how children are schooled makes all the difference. This line of reasoning is also supported by results from the analyses of PISA data in 2000 and 2003, which showed that the Nordic countries are not only more effective but are more equitable, while in Central European countries, including Hungary, family socio-economic status has a much greater impact on students' results (OECD, 2001; 2004). Using two dissimilarity indexes constructed on the basis of PISA data, Jenkins, Micklewright, and Schnepf (2006) found that the school systems with separate academic and vocational tracks are more segregated along socio-economic lines than those without much tracking.

In summary, both theory and empirical evidence suggest that early stratification of students into different curricular tracks increases inequality in educational outcomes and aggravates the effects of students' socio-economic status. We further illustrate this point in this paper by studying the relationship between tracking and students' learning outcomes in Hungary.

Tracking in the Hungarian school system

The Public Education Law of 1993 grants school choice for every parent and allocates the grants according to the number of students in schools. The system is not a "textbook" voucher scheme, since per student lumpsum grants are transferred to the school-maintainers and not directly to the schools, allowing the maintainers, who may have more than one institution, to allocate the received funds among the schools as they wish. Therefore, the money must only follow the student from one school to another, if the school maintainer also changes due to the school change. Central government so far has only set input or process measures, like the national curricula – which is also highly permissive, schools can select among more than a dozen nationally approved curricula, or develop their own – the qualification of teachers, or the textbooks.

Under this arrangement, schools are free to select and admit only those that fit their own criteria. A central entrance examination is offered at the end of grade eight, which schools can refer to when selecting students. In addition to the written results, some schools also conduct face-to-face interviews with applicants in making admission decisions.[1]

The important peculiarity of the Hungarian system is its early stage of selection. After the first eight years of comprehensive study, which covers primary and lower secondary levels,[2] students continuing on to upper secondary level face three types of programmes or tracks: academic, vocational secondary, and vocational training. While primary and lower secondary schools tend to be similar in terms of curriculum and the initial goals, this is no longer the case at the upper-secondary level. For instance, vocational training school does not offer the secondary school diploma, a prerequisite for studying in higher education institutes. This alone pushes most of the academically strong students to opt for academic or vocational secondary schools in order to be able to continue to tertiary education. The superior performance of academic students over their counterparts in vocational secondary programmes has been confirmed in the annual report on the upper-secondary students continuing studies in tertiary institutes published by the National Institute for Public Education, whose database does not include students attending vocational training schools (Neuwirth, 2005). Thus, it will be useful to document the extent to which the performance of vocational training students is similar to or different from that of these two tracks.

Research questions

In our paper, we use the PISA 2003 data to explore the following questions:

- How different are the mathematical literacy scores of 15-year-old students attending academic, vocational secondary, and vocational training programmes in Hungary?
- To what extent are such differences attributable to students' family background?
- To what extent are such differences further attributable to differences in school resources?
- Can we assume that the remaining differences are due only to sorting reasons or there are also problems of different school quality? In other words, what was the role of sorting on the basis of prior academic ability in explaining the differences in mathematical literacy scores among the three programmes?
- Given the importance of students' attitudes towards learning mathematics, how did the three programmes differ in their attitudes towards learning mathematics?

Data and methodology

The Hungarian sample of PISA 2003 data contains 4,765 students of grade seven or above attending 253 schools, including 1,618 students from fifty-two academic tracks, 1,852 students from sixty vocational secondary tracks, and 901 students from thirty-two vocational training tracks. The sub-sample used for our analyses excluded 394 students attending 110 primary schools. In a two-stage sampling process, schools were first selected and then a random sample of 15-year-old students in the sampled school was selected. Since many Hungarian upper secondary schools run both academic and vocational programmes, the selection of students at the second stage of sampling was typically restricted to a particular programme. Thus, information about the school in effect would refer to the programme since respondents to the school questionnaire were asked to refer only to the programme type surveyed.

We used two-level hierarchical linear regressions to account for clustering of students within schools or programme. Based on our research questions, we focused on two types of dependent variables in our analysis. The first was mathematics score, which consists of five plausible values of mathematical literacy. We replicated the analysis substituting this dependent variable with the PISA reading literacy scores and found the results were quite similar. The second type was a set of five indices of student attitudes towards math.

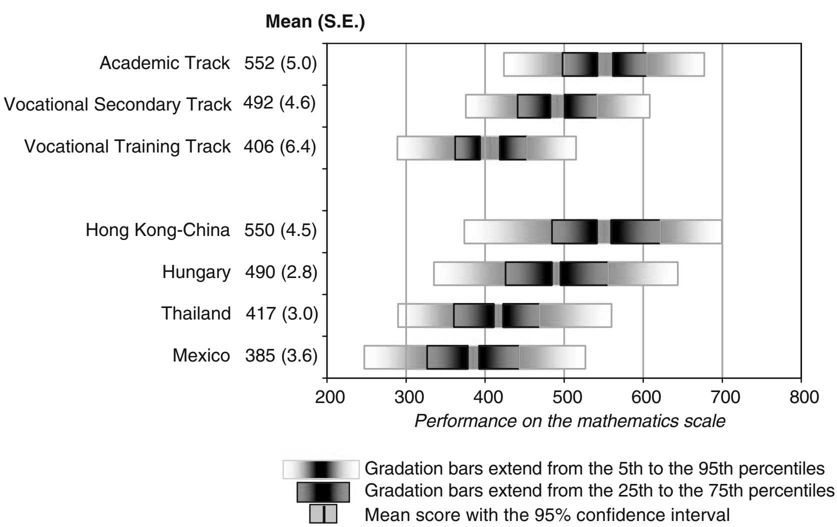
A problem arises when one uses PISA data to study school effects. The target population of the PISA study is students of age 15, most of whom just started their upper secondary education at the time of the PISA study. Students' performance in literacy tests reflects what they have learned accumulatively from primary and lower secondary schools. Thus, it is not entirely appropriate to draw conclusions about school effects by looking at the characteristics of the upper secondary schools that they currently attend. However, such data are adequate for us to establish statements about the socio-economic composition of schools, the performance of the students in each track, the effect of socio-economic status on performance, and thus draw inferences about the mechanisms by which students are sorted into schools.

Data analysis

RAW DIFFERENCES IN MATHEMATICAL LITERACY SCORES

Figure 1 is a graphic display of the distribution of mathematical literacy scores of 15-year-old students from the three tracks in comparison to a selected number of countries in PISA 2003. While the overall dispersions of the score distribution, as indicated by the total length of the bars, are relatively modest, the gaps in the mean scores are dramatic. For instance, vocational secondary students on average scored 492 points, similar to the average level of the entire Hungarian sample. However, academic students scored 552 points, at a similar level to students from Hong Kong (China), the

FIGURE 1. Distribution of mathematics scores in different schools tracks in Hungary.



Source: PISA 2003.

highest performing population in PISA mathematical literacy scores in 2003 out of a total of forty countries. In contrast, vocational training students scored 406 points on average, putting this group somewhere between Thailand (417 points) and Mexico (385 points) which were ranked among the bottom countries in the PISA study.

There are two explanations for the dramatic differences in student performance among the three tracks in Hungary. One is that quasi-similar students enter schools of different quality and better academic schools improve the students much more than vocational secondary or vocational training schools do. The other explanation is that schools are of equal quality, but the underlying mechanisms allow the performance sorting to happen so that the three programme enrol students of very different abilities. The ensuing analyses help to establish whether the reality is closer to the first or to the second scenario. It is vital to distinguish this because each scenario requires entirely different policy initiatives.

PERFORMANCE DIFFERENCES ATTRIBUTABLE TO SOCIO-ECONOMIC BACKGROUND

The results of the basic regression are shown in Table 1. The first model estimated the raw differences in mathematical literacy scores among the three tracks after considering design effects. The second model controlled for individual level variables, such as the SES, gender, and the grade level. After these individual variables were taken into account, the large raw performance differences between tracks became much smaller but did not disappear. The next model further controlled for the school level mean of the students' SES (the third column). As can be seen, the differences between academic and vocational secondary tracks disappeared.

The result in the third column is crucial in understanding the segregation mechanisms in the Hungarian education system. It could be that these two track types – academic and vocational secondary – are only signals for different status parents to select between schools. Higher status parents tend to choose academic tracks while middle-class families opt for vocational secondary schools in order for their children to continue in post-secondary education. Therefore, it is the sorting mechanism of the system that generates the initial performance differences between the academic and the vocational secondary schools.

A more interesting issue in Hungary is the status of the vocational training track. The enormous gap of 85 points in the mean scores between vocational secondary and the training tracks diminished to 32 points after controlling for mean SES, which is still significant both statistically and practically. Here the next research question arises: To what extent are such differences further attributable to differences in school resources? We used several measures of school resources provided in the PISA database to address this question. These measures included student/teacher ratio, the quality of material resources and the shortage or the quality of teachers.

DIFFERENCES IN SCHOOL PERFORMANCE AND RESOURCES

Two things can be said about the effect of school resources on student performance. First is that mean SES does correlate with some of the resources significantly. The *quality of*

TABLE 1. Predicting mathematical literacy scores

Mathematical literacy, PISA 2003	*Basic*		Individual controls		Mean SES		Resources wo/ mean SES		Resources w/ mean SES	
Track level variables	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*
Intercept	490,480***	(4,847)	493,549***	(4,675)	505,001***	(3,833)	473,765***	(21,635)	504,807***	(11,969)
Academic (d)	60,994***	(7,681)	56,761***	(7,181)	7,044	(7,175)	59,078***	(6,528)	11,423	(7,106)
Vocational training (d)	−86,071***	(7,542)	−78,600***	(6,860)	−33,827***	(5,858)	−77,462***	(6,674)	−34,267***	(6,382)
Mean SES (norm)					75,589***	(5,948)			72,693***	(6,718)
School size							0,046***	(0,011)	0,024***	(0,009)
Teacher/student							0,078	(0,578)	0,105	(0,494)
Proportion of certified teachers							−12,295	(19,860)	−17,601*	(10,296)
Computer ratio to school size							27,090*	(11,748)	10,935	(8,880)
Quality of material resources							5,918**	(2,927)	2,584	(1,941)
Shortage of teachers							−3,388	(2,988)	2,027	(2,421)
Individual level variables										
Female (d)			−26,534***	(2,510)	−26,252***	(2,464)	−26,488***	(2,504)	−26,114***	(2,464)
Grade (d)			31,845***	(2,481)	32,088***	(2,485)	31,784***	(2,484)	32,014***	(2,489)

Table 1. Continued

Mathematical literacy, PISA 2003	*Basic*	Individual controls		Mean SES		Resources wo/ mean SES		Resources w/ mean SES	
SES (norm)		10,721***	(1,411)	9,397**	(1,425)	10,544***	(1,419)	9,407***	(1,426)
U0	36.138	32,578		23,389		30,506		22,859	
R	63.728	60,401		60,399		60,397		60,399	
Level 1 units: 4358									
Level 2 units: 143									

Note: Missing values are imputed, and are controlled for.
(d) - dummy, (norm) - N(0,1)

material resources and the *computer ratio to school size* showed significant impact on the mathematical literacy scores only if mean SES was not controlled for. This result means that those schools that have higher average SES, which tended to have higher scores, also have better quality resources. Second, controlling for resources did not affect the differences between tracks. In other words, the relationship between school performance and resources is similar for each track. Hence, the question still remains: why are there adjusted performance differences between the vocational secondary and the vocational training tracks?

SORTING OR SCHOOL QUALITY

It might be that there is not only socio-economic sorting, but also ability sorting taking place. Academic schools and vocational secondary schools "skim off" the best students, and although SES correlates highly with ability, controlling only for the former does leave some space for ability sorting. In order to test this hypothesis, we examined the extent to which previous academic record (including entrance exam results) was a consideration for school admission by different tracks. While both academic tracks and vocational secondary tracks value the applicants' previous academic records seriously, very few vocational training schools did so.

We then used a regression model including a dummy variable representing whether previous academic record was considered in admitting students and fitted this model for each track separately.[3] The results indicated that the hypothesis of sorting holds (Table 2). Our analysis showed that ability selection mechanisms did not play a significant role for the academic track, though this might be due to the small variation of the proxy variable within the examined sub-population.[4] Students in vocational secondary schools expecting their applicants to have a good academic record seemed to perform better than those who "only" took it into account. This result is especially robust, since it holds even after controlling for mean SES. The most selective vocational training schools seemed to perform better too, though the effects of selection disappeared after controlling for school SES.

Although these results need to be handled with care, because of the questionable meaning of the admission proxy, they seem to support the hypothesis of *ability selection besides socio-economic status selection.* Academic schools do select children by ability. However, since all academic schools practice the selection, the ability differences within the track would be small, but selection via socio-economic status is the strongest here. Vocational secondary schools vary in the degree of ability selection, and those that place a greater effort on it, show higher mathematical literacy scores. Correspondingly, SES selection is also stronger here than in vocational training schools. Finally, the few vocational training schools that can use ability selection perform somewhat better. However, it is likely that ability selection only picks out higher status, and not more able students.

STUDENTS ATTITUDES TOWARDS LEARNING MATHEMATICS AND SCHOOL QUALITY

Now we turn our attention to students' attitudes towards learning mathematics. Despite the difficulty in disentangling the exact direction of causation between attitudes and

TABLE 2. Predicting mathematical literacy scores for different tracks

Mathematical literacy, PISA 2003	Academic track				Vocational Secondary track				Vocational Training track			
			With mean SES				*With mean SES*				*With mean SES*	
Track level variables	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*	*B*	*(s.e.)*
Intercept	550,185***	(12,928)	515,213***	(11,174)	473,932***	(5,582)	500,356***	(5,641)	405,982***	(8,981)	461,494***	(15,923)
Mean SES (norm)			69,626***	(9,692)			74,619***	(9,649)			72,169***	(20,762)
Academic record: yes (d)					18,549*	(10,765)	0,245	(9,023)	−15,064	(11,071)	−11,902	(8,404)
Academic record: prerequisite (d)	0,379	(13,816)	0,259	(10,696)	31,775***	(7,465)	11,523*	(5,939)	23,245**	(10,904)	14,792	(9,927)
Individual level variables												
Female (d)	−29,319***	(3,847)	−29,414***	(3,815)	−30,417***	(3,829)	−29,599***	(3,704)	−15,889**	(6,037)	−14,961**	(6,002)
Grade (d)	32,670***	(3,909)	32,935***	(3,910)	30,696***	(3,675)	31,027***	(3,694)	31,732***	(5,089)	31,814***	(5,095)
SES (norm)	12,636***	(2,271)	11,421***	(2,314)	8,597***	(1,990)	7,332***	(2,028)	9,616**	(4,140)	8,515**	(4,128)
U0	36,88958		27,855		28,639		20,005		25,583		21,018	
R	61,96068		61,972		59,204		59,193		59,114		59,083	
Level 1 units:	1617				1846				882			
Level 2 units:	52				60				31			

Note: Missing values are imputed, and are controlled for.
*** Significant at 1%, ** Significant at 5%, * Significant at 10%
(d)—dummy, (norm)—N(0,1)

actual achievement, it is believed that positive attitudes towards academic work engender study habits and good learning outcomes. Positive attitudes also contribute to life-long learning, which make fostering desirable attitudes a learning goal in itself. For these reasons, we examine whether there are any differences in attitudes towards math between the tracks, and whether they change through grade progression or remain stable. This latter issue is especially crucial, since a change in attitudes would implicitly suggest an indirect impact of schools on mathematical literacy. The reason is that literacy scores are relatively stable through time. If attitudes change, we could assume that it is not due to the changing mathematical performance but rather to the schools themselves.

We used five indices of attitudes developed in PISA 2003, referred to as "self-related cognitions in mathematics." All the indices were standardized to have a mean of zero and a standard deviation of one, with greater values indicating more positive attitudes. The indices represented the following attitudes towards mathematics: (1) Interest and enjoyment, (2) Instrumental motivation, (3) Self-efficacy, (4) Anxiety, and (5) Self-concept.[5] We paid particular attention to the vocational training students since, as shown earlier, they still lagged behind their counterparts from the other two tracks, even after controlling for individual characteristics, school SES, and school resources. We fitted a series of two-level hierarchical linear models to the data, regressing each of the five attitude indices on individual SES, grade level, gender, the track dummies and interactions between grade and track dummies. The results of the analyses are summarized and presented in Table 3.

TABLE 3. Differences in attitudes towards mathematics across grade levels and tracks

	Differences in attitudes between tracks (as compared to vocational secondary)		Difference in attitudes between grades 9 and 10 (as compared to vocational secondary)		Difference in attitudes between grades 9 and 10 (in vocational secondary tracks)
	Academic	Vocational training	Academic	Vocational training	
Interest and enjoyment	0	0	0	0	0
Instrumental motivation	0	0	+	0	−−−
Self-efficacy	+++	−−−	0	−−	+++
Anxiety*	+++	0	0	+	0
Self-concept	++	++	0	0	0

Notes: positive relationship + significant at 10%; ++ significant at 5%; +++ significant at 1%
negative relationship: − significant at 10%; −− significant at 5%; −−− significant at 1%
0 not significant
* Note that we reversed the anxiety index; lower values mean higher anxiety.

The first two columns illustrate the extent to which academic and vocational training students differed from their vocational secondary counterparts (the comparison group) in the attitudinal indices. As can be seen, the vocational training students showed lower self-efficacy but higher self-concept than the vocational secondary students. In addition, they had the same level of interest and enjoyment, instrumental motivation and anxiety as the vocational secondary students. Consequently, we cannot claim that vocational training students had inferior mathematical literacy scores because they approached the subject more negatively. Compared to their vocational secondary counterparts, academic students were about the same on two indices, but had higher values on the other three indices, though most of such differences disappeared – just as the difference in mathematical literacy scores – after controlling for school SES.

The effects of grade progression, on the other hand, seemed to diverge between tracks. This divergence, especially in self-efficacy in mathematics, could pose a longer-run problem. If the attitudes of vocational training school students become more negative through grade progression, the existing achievement gaps between vocational training track and the other tracks, which are already large, will get even worse. Students of vocational training schools, beginning to have more negative attitudes towards math, will have a harder time to accommodate to future challenges in life. Obviously, this is only an assumption we make on the basis of the above computations. Further research, based on longitudinal design, is needed to establish whether training schools are of worse quality, or this is just a spurious correlation we observe here.

Conclusion

In this article, we examined inequalities in the Hungarian education system by exploring the disparities in learning outcomes among academic, vocational secondary and vocational training tracks, as well as a number of factors related to such disparities. The dramatic achievement gaps among the three tracks, especially the predominantly low level of achievement among the vocational training students, are a cause of concern. At the same time, targeting the vocational training students can be the starting point for any attempts to either raise the overall performance of the Hungarian students or to close the achievement gaps within the country.

Pinpointing the exact causes, and therefore designing specific interventions, is a complex and challenging task. However, we learned through our analyses that a large part of such achievement gaps are related to differences in students' family SES. After considering differences in the SES composition of schools, the gap in mean scores between academic and vocational secondary tracks disappeared and that between vocational training and vocational secondary tracks was further reduced to about one-third of the original size. While such results suggest that the superior performance of the academic track may be due to the high ability and high status students that it selects, the performance advantage of the vocational secondary track may be a result of its ''skimming-off'' the best ability but lower-status students, and thus leaving vocational training schools with the least able, lowest status group. Despite this, the effects of individual and school SES in "explaining away" the achievement differences between the tracks may suggest that there are additional differences among the tracks that are important to student learning. Our analysis confirmed that school SES did correlate with two measures of resource quality, which were also associated with student performance in mathematical literacy. Even though it is imprudent to suggest that simply investing in more resources in vocational secondary and particularly vocational training tracks will necessarily close the achievement gaps they have compared to the academic track, it is nevertheless useful for school-level interventions to start looking at whether vocational secondary and vocational training tracks may suffer from deficits in physical and human resources.

A worrying sign is that the attitudes of vocational training school students towards mathematics seem to become more negative as the progress from grade nine to ten, as compared to the other two – and especially the academic – tracks. This could, in the long run, worsen the already not-so-good mathematical literacy skills of the vocational training school students.

Notes

1. See Lannert and Halász (2004) for a detailed description of the Hungarian public education system. Also note that Hungary has recently introduced a law requiring primary schools to use a lottery when allocating vacant places among applicants outside their catchment area.
2. The exceptions are the so-called small-academic schools that last for eight or six years (from grade five or seven to grade twelve), which skim off the best students at a very early stage.
3. The use of interaction variables in the original regression was not possible due to high colinearity problems.
4. We let the "Academic record important: yes" become the comparison category, since there were only two cases in the "maybe" box, and we considered them as outlier cases.
5. Please refer to OECD (2004) for a detailed description of the definition and the methods of constructing these indices.

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