Social inequality in educational transitions under different types of secondary school curricular differentiation

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Abstract

Secondary school curricular differentiation has been organized in a variety of ways across schools, across countries and over time. Two types of differentiation are course-by-course tracking, in which courses are offered at varying levels of difficulty in one or more subjects within a school (often practised in the USA, the UK, Australia and other Anglophone countries) and academic and vocational streaming, in which students are allocated into overarching programmes with curricula that prepare them either for university or for trades (traditionally practised in Germany, France, the Netherlands and other continental European countries). Both forms of differentiation have been criticized for segregating students by socio-economic status (SES) and directing low-SES students into lower-status educational trajectories. But differences between the two types of differentiation may lead to differences in the level of social inequality produced. This chapter reviews the emerging literature comparing the two types of curricular differentiation with a focus on SES segregation between tracks, student achievement, academic self-concept, educational aspirations and resulting levels of social inequality in educational attainment.

Introduction

Curricular differentiation is a set of educational practices that make different knowledge available to different groups of students, according to ability, prior achievement, student interest, parental preferences and/or the judgement of teachers or other school personnel (Oakes et al., 1992). Such practices have been organized in a variety of ways across schools, across countries and over time, including tracking, streaming, ability grouping (known as setting in the UK), and selecting students into academic or vocational school types. All of these practices are designed to ease teaching by creating more homogeneous learning environments. However, curricular differentiation has also been criticized for exacerbating educational inequality—defined here as the association between students' socio-economic origins and their educational attainment. Across many different national contexts, scholars have found that separating students by prior achievement tends to segregate students by socio-economic status (SES) and to direct low-SES students into lower-status educational trajectories (Brunello and Checchi, 2007; Ireson and Hallam, 2001; Oakes, 1985).

Yet it is possible that some types of curricular differentiation may lead to less educational inequality than others, particularly types that are organized in a less rigid, more fluid manner: those that begin at later ages, that allow students to be re-grouped from year to year or from subject to subject, and that do not use widely-diverging curricula in different tracks. Alternatively, it could be the case that all types of curricular differentiation produce similarly high levels of educational inequality, if high-SES families are able to take advantage of these policies to pursue better educational outcomes for their own children. As more and more countries look to reform their school systems to create more equitable forms of curricular

differentiation, it is useful to survey the wide range of policies in place internationally and their consequences for educational inequality.

Different Types of Curricular Differentiation in International Comparison

Dupriez et al. (2008) adapt the prior work of Mons (2007) to create a four-type classification of curricular differentiation policies in Western countries. The types are: (1) the separation model, in which students are selected into separate academic and vocational tracks near the beginning of lower secondary school (practised in continental European countries such as Germany, Hungary and the Netherlands), (2) the a la carte integration model, in which students attend comprehensive secondary schools with relatively common core curricula but are grouped between classrooms based on their performance in each school subject (practised in Anglophone countries such as the US, the UK, Australia and Canada), (3) the uniform integration model, in which formal tracking is delayed to later ages and students follow a standardized core curriculum, but high rates of grade retention create curriculum differentiation between grades (practised in southern European countries such as France, Spain and Portugal), and (4) the individualized integration model in which there is no vocational tracking until later ages and very little ability grouping, and differentiation occurs mainly through individualized instruction within classrooms (practiced in Nordic countries such as Finland, Norway and Sweden).

Significance of the Two Focal Models

This chapter focuses primarily on two of the models of curricular differentiation described above: what Dupriez et al. (2008) call the separation model and the a la carte

integration model. For consistency with other literature reviewed here, this chapter refers to the separation model as academic and vocational streaming and refers to the a la carte integration model as course-by-course tracking. Of the four models, these two are more formalized because they involve assigning students to instructional groups with different curricula based on achievement. Another reason to focus on these two types of differentiation pertains to policy. Several authors have noted that education policies in many countries appear to be shifting from academic/vocational streaming to course-by-course tracking. Dupriez et al. (2008) refer to their four different models of curricular differentiation as 'connected vessels' (p. 254), meaning that extensive use of one model is typically associated with limited use of the others. Similarly, Chmielewski (2014) observes that academic/vocational streaming and course-by-course tracking appear to function in a trade-off relationship. Worldwide, academic/vocational streaming is declining, with the USA, the U.K., Sweden and Finland implementing reforms in the 1960s and 70s (Feinstein and Symons, 1999; Heidenheimer, 1974; Lucas, 1999; Manning and Pischke, 2006; Pekkarinen, 2005) and Spain and Poland reforming in the 1990s and 2000s (Ariga et al., 2005; OECD, 2004).

Even in countries that have not formally eliminated academic/vocational streaming, the practice has declined in a more informal way, as more students are selected into the academic stream and fewer into the vocational stream. Benavot (1983) observed that as early as 1975, the share of secondary school students in vocational streams was already declining noticeably in many different world regions. In many countries, course-by-course tracking appears to be replacing academic/vocational streaming. For example, in German comprehensive schools (*Gesamtschulen,* which enrol 10 percent of students as an alternative to the traditional tripartite system), within-school course tracking is mandated by law (Trautwein et al., 2002).

Since many countries are replacing academic/vocational streaming with course-by-course tracking, either through major reforms or gradually over time, it is important to ask whether these countries are trading an explicitly unequal system for an implicitly unequal one. This chapter asks: how different are academic/vocational streaming and course-by-course tracking in terms of their effects on educational inequality? Do the two types of curricular differentiation differ in degree or in kind?

Data

This chapter first presents some original descriptive statistics on changing curricular differentiation practices and then reviews recent research comparing the effects of academic/vocational streaming and course-by-course tracking on educational inequality. The data for the description of changing curricular differentiation are drawn from the five most recent cycles of the Programme for International Student Assessment (PISA) in 2003, 2006, 2009, 2012 and 2015. Conducted by the OECD, PISA tests 15-year-old students (regardless of grade) in reading, mathematics and science. For more fine-grained comparisons of these two types of curricular differentiation, the 2003 cycle of PISA is an ideal dataset because it contains student-level information on student track locations for both types of curricular differentiation. In academic/vocational streaming countries, PISA 2003 includes student-reported academic or vocational study program; in a select number of course-by-course tracking countries, it includes student-reported level of maths course. In all countries, PISA 2003 also includes principal-reported between-classroom ability grouping for maths courses, as well as measures of students' socio-economic status, academic self-concept and educational aspirations based on student questionnaires. PISA samples approximately 5000 students in each participating country; the

analyses reported below focus on the 28 wealthiest countries that have been OECD members since 2003.

Describing Current Policies on Curricular Differentiation

Figure 1.2.1 provides evidence of a potential trade-off relationship between the two types of curricular differentiation. Using PISA 2003 data, it plots the percentage of students in each country who report following a vocational stream (an indicator of the extent of academic/vocational streaming) against the percentage of students whose school principals report using between-classroom ability grouping for some or all maths classes (an indicator of course-by-course tracking). The figure demonstrates a moderately strong negative relationship between the two types of curricular differentiation: Countries with high proportions of students in the vocational stream, such as Austria (79 per cent), Germany (61 per cent) and Hungary (59 per cent), tend to have the lowest rates of maths course tracking (at or below 50 per cent of schools), while the countries with very low proportions of students in the vocational stream, such as the USA (0 per cent), Canada (0 per cent) and England (1 per cent), tend to have very high rates of maths course tracking (over 95 per cent of schools).

(Figure 1.2.1 about here)

Table 1.2.1 reproduces this finding, while adding updated data from later years of PISA (2006, 2009 and 2012), which allows us to examine changes over this 9-year period. It should be noted that nearly every country practices at least moderate rates of between-class maths tracking, and that these rates are generally somewhat higher in 2012 than those seen in Figure 1.2.1 for

2003. Between 2003 and 2012, the practice of between-class maths tracking appears to have increased in some parts of the world. In the two Asian countries, maths class tracking increased about 17 percentage points over these 9 years, and in the continental European countries, it increased on average about 6 percentage points. In some of these European countries, the increases were much larger, particularly Germany and Hungary. In Anglophone and Southern European countries, the practice remained relatively stable, while in the mostly Nordic individualized integration countries, there was a great deal of variation, with large declines in maths class tracking in Norway and Poland and large increases in Denmark and Finland. At the same time, vocational streaming declined slightly in all regions and all differentiation models, with the largest declines in the French community of Belgium, the Czech Republic and the Slovak Republic. In sum, it appears that over the course of only 9 years, vocational streaming has generally declined across OECD countries, consistent with earlier trends noted by Benavot (1983). At the same time, between-class maths tracking has generally increased—a trend that has not yet been widely noted in the literature. Thus, it may be the case that these two models of curricular differentiation function as connected vessels or in a trade-off, not only when comparing different countries or sets of countries but also when comparing changes over time within countries.

(Table 1.2.1 about here)

Consequences of Differentiation for Educational Inequality

In comparing the effects of curricular differentiation on educational inequality, one might assume that course-by-course tracking produces less inequality than academic/vocational

streaming because its formal institutional structure is less rigid. Course-by-course tracking typically begins at later ages than academic/vocational streaming, which some authors have argued should result in lower socio-economic segregation between tracks because family SES exerts less influence on educational transitions at older ages (Shavit and Blossfeld, 1993). In addition to lower SES segregation, many scholars argue that course-by-course tracking creates learning environments that are less unequal and less apt to direct low-SES students into lower-status educational trajectories (Brunello and Checchi, 2007; Hanushek and Wößmann, 2006; Schütz et al., 2008). Sociological theory characterizes the effects of curricular differentiation as operating through three mechanisms: instructional, social and institutional (Lucas, 1999; Pallas et al., 1994). Instructional effects pertain to differentiation of students' opportunities to learn through differences in curriculum and instruction and are expected to affect students' achievement in the form of test scores and course grades; social effects refer to differentiation of social or peer environments and are expected to affect students' motivation, academic self-concept and educational aspirations or expectations; institutional effects concern the formal recognition of tracks or streams in the wider society outside of the school and are expected to affect students' likelihood of transitioning into particular higher education or labour market destinations (Lucas, 1999; Pallas et al., 1994). Clearly, these three mechanisms are interrelated, as for example, students' achievement levels shape their academic self-concept, and formal linkages between track locations and higher education (such as the German requirement of passing the final *Gymnasium* examination, the *Abitur*, for university entry) shape students' educational aspirations. Thus, academic/vocational streaming may produce more inequality than course-by-course tracking because its earlier onset, lower rates of transfer and more explicit track definitions produce a wider divergence between tracks in opportunities to learn (instructional),

peer environments (social) and educational and occupational destinations (institutional), compared to the more fluid system of course-by-course tracking.

An alternative perspective holds that course-by-course trades an explicitly unequal system for an implicitly unequal one. In particular, course-by-course tracking may produce a similar level of inequality to academic/vocational streaming but less realism or alignment of students' self-perceptions with their true performance and students' educational and occupational aspirations with their likely destinations. This perspective includes scholarship on the US course-by-course tracking system showing a weak association between achievement and university aspirations (Kerckhoff, 1977), a lack of awareness of which high school coursework is necessary to prepare for higher education (Schneider and Stevenson, 1999) and a hidden system whose complexity disadvantages low-SES students (Lucas, 1999). Thus, the implicit inequality perspective contends that instructional and institutional effects are similar in both types of curricular differentiation, but social effects are weaker in course-by-course tracking than in academic/vocational streaming. In other words, low-track students in course-by-course tracking are exposed to lesser opportunities to learn and are directed into lower-status educational trajectories, but are located in a social environment that does not strongly signal this situation, and therefore they may still have high academic self-concept, educational and occupational aspirations.

The following sections of this chapter review recent research comparing the effects of academic/vocational streaming and course-by-course tracking on educational inequality, organized according to SES segregation and the three mechanisms through which tracking operates. The review focuses on research that compares course-by-course tracking to academic/vocational streaming using student-level data on track location (i.e., whether each

student in the sample is in the high, middle or low track) rather than aggregated country- or system-level measures. This is an important distinction because aggregated measures can indicate only whether academic/vocational streaming countries have higher inequality than course-by-course tracking countries (such as a stronger association between SES and university access) but only student-level track data can reveal whether low-track students are less likely to access university in academic/vocational streaming countries than in course-by-course tracking countries. The ideal data for such a study would be longitudinal data following students in different tracks over time in countries with different types of curricular differentiation. Currently, all international large-scale assessments are cross-sectional rather than longitudinal, and only PISA 2003 has student-level track information for both types of curricular differentiation (as described in the Data section above). Additionally, some authors collected original longitudinal data following students in different types of curricular differentiation, which provides the highest-quality information inequality in educational transitions under the two types of curricular differentiation.

Socio-economic Segregation between Tracks

Generally, empirical research finds that course-by-course tracking is less segregated than academic/vocational streaming. Three studies are reviewed below, moving from the research with the least preferred data source (aggregate country-level measures) to the most preferred (longitudinal student-level measures). Dupriez et al. (2008) use aggregated measures derived from PISA 2003 data to examine low-achieving students' school SES composition. They find that the gap between the school SES composition of low-achieving and other students is greater under academic/vocational streaming than under course-by-course tracking. Chmielewski (2014) uses cross-sectional data from PISA 2003 with student-level track information for 3 countries

practising course-by-course tracking and 17 countries practising academic/vocational streaming to examine SES segregation between tracks. Figure 1.2.2 displays Chmielewski's (2014) finding that academic/vocational streaming is more socio-economically segregated than is course-by-course tracking. While the SES gap between the middle and low tracks is similar in both types of tracking, the gap between the middle and high tracks is much larger in academic/vocational streaming than in course-by-course tracking. In other words, high-SES students are very concentrated in the high track in academic/vocational streaming countries.

(Figure 1.2.2 about here)

Schnabel et al. (2002) use original longitudinal data with student-level track information to compare the effects of SES on track placement and learning gains between seventh and tenth grades in Germany and the USA. The German data are derived from a study of students in two West German states in the 1990s; the US data are derived from a study of students in 12 Midwestern school districts in the 1980s. Track placement is defined as academic or vocational school type in Germany (*Gymnasium* versus non-*Gymnasium*) and as academic maths and English tracks in the USA (defined by enrolment in advanced courses). Regarding SES segregation between tracks, Schnabel et al. (2002) find that prior achievement is the strongest predictor of track placement in both countries, but that SES still has an independent effect on track placement in both countries, after controlling for achievement. Although SES segregation between tracks is substantial in both countries, tracks are more segregated in Germany than in the USA. Thus, all three studies found that course-by-course tracking is less segregated than academic/vocational streaming.

Instructional Mechanisms

Evidence for the instructional mechanism of curricular differentiation comes from studies of achievement gaps or differences in learning gains between tracks. Dupriez et al. (2008) examine country-level aggregated measures of inequality in achievement to compare the different types of curricular differentiation. They find that there are no significant differences between the two types of tracking in the overall variation (standard deviation) of maths scores. Huang (2009) uses aggregated country-level measures from the 2003 Trends in International Mathematics and Science Study (TIMSS) to study the effects of curricular differentiation on the variation (standard deviation) of maths achievement. TIMSS samples intact classrooms of fourth-grade and eighth-grade students, meaning that differences between classrooms capture both between-classroom and between-school curricular differentiation. Huang (2009) compares the fourth-grade and eighth-grade TIMSS cohorts using fixed effects models and finds that achievement diverges more in countries with more homogeneous classrooms, i.e. countries with greater curricular differentiation. The purpose of Huang's (2009) study was not to compare course-by-course tracking to academic/vocational streaming; however, his results include three academic/vocational streaming countries (Belgium-Flanders, Hungary and the Netherlands) and four course-by-course tracking countries (Australia, New Zealand, Scotland and the USA). Comparing these two groups of countries, both the overall standard deviation of maths achievement and the proportion of variation in maths achievement that occurs within classrooms versus between classrooms or schools is similar in academic/vocational streaming and course-by-course tracking. Thus, Huang's (2009) results indicate similarity between the two types of curricular differentiation.

Likewise, Chmielewski (2014), using student-level track information for both types of curricular differentiation, also finds similarity in achievement gaps between tracks in the two types of curricular differentiation. Figure 1.2.3 shows that the achievement gap between the middle and high tracks is slightly larger in course-by-course tracking, while the achievement gap between the middle and low tracks is significantly larger in academic/vocational streaming. Yet the overall gap between the high and low tracks is very similar in size in both types of tracking.

(Figure 1.2.3 about here)

Regarding learning gains between seventh and tenth grades, Schnabel et al. (2002) find that academic tracks make greater learning gains than lower tracks in both countries, and that after controlling for track, there are no remaining SES differences in learning gains. Although differences between tracks in learning gains are substantial in both countries, they are larger in Germany. Thus, due both to greater SES segregation of tracks and greater learning differences between tracks, the authors find that the association between SES and achievement grows in Germany between seventh and tenth grades, while it does not change in the USA between these ages.

Thus, there is mixed evidence on achievement gaps between tracks in the two types of curricular differentiation. The studies using cross-sectional data for a large number of countries tend to find similar achievement differences between tracks in academic/vocational streaming and course-by-course tracking. The one study using longitudinal data for two countries finds greater learning gaps between tracks in Germany than in the USA. This difference may depend on the difference between examining achievement gaps in cross-section rather than achievement

gains using longitudinal data; and/or it may depend on the sample. Chmielewski (2014) finds that Germany has among the largest achievement gaps between tracks; thus, Germany may be particularly unequal, even compared to the other academic/vocational streaming countries.

Social Mechanisms

Both the explicit and implicit inequality perspectives described above predict larger social effects of academic/vocational streaming than of course-by-course tracking. Below, results from empirical research are reviewed for two different social outcomes of curricular differentiation, academic self-concept and educational aspirations. In the case of aspirations, both perspectives above are borne out, as aspirations gaps between tracks are larger between tracks in academic/vocational streaming than in course-by-course tracking. Yet for academic self-concept, empirical research shows the reverse of the predicted pattern: larger effects for course-by-course tracking than for academic/vocational streaming.

Dupriez et al. (2008) find that although low-achievers have lower maths self-concepts than higher-achieving students under all types of curricular differentiation, this gap is smaller under academic/vocational streaming than under course-by-course tracking. They interpret this as evidence for the 'big-fish-little-pond effect' (Marsh, 1987), which states that, all else equal, being in a relatively high-achieving environment has a negative effect on academic self-concept. Under academic/vocational streaming, low-achieving students are most isolated from their high-achieving peers, while in course-by-course tracking, low-achieving students have a higher level of exposure to high-achievers.

Figure 1.2.4, based on results from Chmielewski et al. (2013), provides further evidence on the relationship between curricular differentiation and academic self-concept, using the

student-level track information available in PISA 2003. Whereas in course-by-course tracking, students in higher tracks have higher maths self-concepts, in academic/vocational streaming, students in higher tracks have lower maths self-concepts. Chmielewski et al. (2013) further separate academic/vocational streaming systems into those that stream students within schools and those that stream between schools, thus separating the effects of sharing a school building from the effects of the style of tracking (overarching streams that determine a student's entire study programme versus course-by-course tracking). They find that the style of tracking appears to matter more to students' maths self-concepts than does sharing a building, since the pattern for within-school streaming more closely resembles that of between-school streaming than it does the pattern for course-by-course tracking—if anything, the pattern for within-school streaming appears *more* extreme than for between-school streaming, with very high maths self-concepts for the students in the lowest tracks. Thus, it appears that course-by-course tracking has larger effects on self-concept than does academic/vocational streaming. This reinforces the idea that different types of curricular differentiation produce different reference groups for students.

(Figure 1.2.4 about here)

Further insight into the processes producing this pattern comes from Trautwein et al. (2006), who use data from the German extension of PISA 2000 study to compare the traditional tripartite academic/vocational streaming system to the smaller sector of German comprehensive schools (*Gesamtschulen*), which practise course-by-course tracking. Like Chmielewski et al. (2013), Trautwein et al. (2006) also find that higher track students have higher self-concepts in course-by-course tracking and higher track students have lower self-concepts in

academic/vocational streaming. They further demonstrate that this difference can be statistically explained by differential teacher assignment of grades. In course-by-course tracking, teachers grade on a curve that includes the entire school, i.e., students from all tracks, while in academic/vocational streaming, teachers grade on a separate curve within each track. Course grades in turn strongly influence students' self-concept. Longitudinal studies from several different countries further strengthen our understanding of the development of students' self-concept over time. Studying maths ability grouping (course-by-course tracking) in the USA, Fuligni et al. (1995) found no effects of track placement on maths self-concept. Thus, it may be the case that for students in the USA and other course-by-course tracking countries, high self-concept is not causally related to being placed in the high track but may predate track placement. On the other hand, in academic/vocational streaming countries, authors have found that high track students initially have higher self-concept, which declines after track placement, presumably because of a shift in reference group (Liu et al., 2005; Schwarzer et al., 1982). A similar finding has been observed in Finland, albeit at a later age, as Finland delays academic/vocational streaming until upper secondary school (Salmela-Aro et al., 2008).

On the other hand, for educational expectations, academic/vocational streaming appears to have larger effects than does course-by-course tracking. Buchmann and Park (2009) examine the effects of SES on track placement and the effects of track location on educational and occupational expectations in five highly differentiated (academic/vocational streaming) countries using PISA 2003 data. They then compare these five countries to five undifferentiated countries in terms of the realism of students' educational and occupational expectations, defined by their alignment with actual levels of university and professional occupation attainment in their country. Four of the undifferentiated countries would be classified in this chapter as course-by-

course tracking countries (Australia, Canada, New Zealand and the USA), and one would fall into Dupriez et al.'s (2008) uniform integration model (Spain). Buchmann and Park (2009) find that track location is a strong predictor of educational and occupational expectations in all five of the academic/vocational streaming countries.

(Figure 1.2.5 about here)

Figure 1.2.5 uses the PISA 2003 data from Chmielewski (2014) for a new analysis examining educational expectations across the two types of curricular differentiation, using student-level track information for both types. The figure shows the percentage of students in each track who expect to attend university, controlling for student SES and maths achievement. While in course-by-course tracking, relatively high proportions of students from all three maths tracks expect to attend university (between 58 to 75 per cent), in academic/vocational streaming, the proportions of students in the low and middle tracks expecting to attend university are very low (under 30 per cent), while the proportion in the high track is much higher (around 58 per cent). Educational expectations are a social phenomenon that is shaped by institutional context as well as by students' social experiences in school. The larger gaps in university expectations between tracks in academic/vocational streaming countries likely reflect in part the reality that academic and vocational streams are indeed more closely linked to post-secondary destinations than are maths course tracks. Additionally, the overall percentage of students in academic/vocational streaming countries who expect to attend university is low, making the proportion of students in the high track who expect to attend university similar to the proportion of students in the low track in course-by-course tracking countries who expect to attend

university. This may be related to the social experiences of students in school; in particular, the low academic self-concepts of high-track students may depress their educational expectations. The expectations of students by track in Figure 1.2.5 are adjusted for student SES and maths achievement, but without these controls, the overall pattern is similar, with larger gaps between tracks.

Institutional Mechanisms

As described above, institutional effects concern the formal recognition of tracks outside of the school and linkages between tracks and post-secondary or labour market destinations. Shavit and Müller (1998) developed this idea through the concept of 'vocational specificity'. In educational systems with high vocational specificity, a high proportion of students leave school with specific skills and occupational identities. Shavit and Müller (1998) generally describe academic/vocational streaming countries as having high vocational specificity (Germany, the Netherlands and Switzerland), while the countries that the present chapter characterizes as course-by-course tracking are described by Shavit and Müller (1998) as either medium vocational specificity (Australia and Britain) or low vocational specificity (Ireland and the USA). The one individualized integration country in their analysis, Sweden, is categorized as medium vocational specificity. Thus, Shavit and Müller (1998) find variation in the level of occupationally-specific skills imparted by course-by-course tracking systems, but consistently find greater levels of such training in academic/vocational streaming systems.

Turning to empirical research comparing linkages between tracks and higher education in the two types of curricular differentiation, we find no existing studies that meet the standard of using student-level track information for both types of curricular differentiation. However, the

available studies paint a picture consistent with Shavit and Müller's (1998) work showing that academic and vocational streams are more strongly linked with post-secondary destinations than are within-school course tracks. A US study shows that, after controlling for demographics and achievement, students taking advanced maths course work are about 50 per cent more likely to enrol in a four-year college than are students not taking advanced maths (Schneider et al., 1998). This is a substantial difference between tracks, but the difference between academic and vocational streams in countries such as Germany is likely much higher. Jackson and Jonsson (2013) report that in the 1983 German birth cohort, conditional on making the transition into *Gymnasium* for lower secondary school (about one-third of the cohort), approximately two-thirds of *Gymnasium* students enter university. Given that in the 1983 birth cohort, only around 20 percent of the entire cohort entered university, this implies that the number of students who were initially selected into a lower stream but ultimately completed the *Abitur* and entered university was very small.

Discussion

In sum, empirical research generally finds that SES segregation is lower in course-by-course tracking than in academic/vocational streaming, consistent with the theory that curricular differentiation is less socially segregating when the high-stakes selection point occurs later (Blossfeld and Shavit, 1993).[1] Achievement gaps appear similar in both course-by-course tracking and academic/vocational streaming, which suggests that curriculum and instruction may be similarly differentiated between tracks in both types. Gaps in academic self-concept between tracks generally appear larger in course-by-course tracking than in academic/vocational

[1] Note that some course-by-course tracking countries, such as the USA, practice other forms of curricular differentiation at very young ages (e.g., elementary school gifted programs (Grissom and Redding, 2016).

streaming, which suggests that students in course-by-course tracking may compare themselves to all other tracks as their reference group, while students in academic/vocational streaming may compare themselves mainly to students in their own track (Chmielewski et al., 2013). Likewise, in course-by-course tracking, teachers may grade on the same curve across all tracks, while in academic/vocational streaming, teachers may grade on a curve within the track (Trautwein et al., 2006). On the other hand, when it comes to university expectations, differences between tracks appear much larger in academic/vocational streaming than in course-by-course tracking. Finally, for students' likelihood of entering university, direct evidence is sparse, but it appears that differences between tracks are probably greater in academic/vocational streaming than in course-by-course tracking.

Thus, neither the explicit nor the implicit inequality perspective is completely borne out by the evidence. It appears that the explicit inequality perspective is supported in the case of institutional effects, which are larger in academic/vocational streaming; the implicit inequality perspective is supported in the case of instructional effects, which are similar in size in both types of differentiation, and neither perspective is supported in the case of social effects, which are unexpectedly larger in course-by-course tracking. Although it might be tempting to conclude based on the well-known finding of weak track effects on educational aspirations that students in course-by-course tracking are unaware of their track location, the strong track effects on academic self-concept in course-by-course tracking show that this is not the case. Students in course-by-course tracking are indeed aware of their track location—it profoundly shapes their self-concept—yet it may be that they do not perceive a strong connection between track and later educational transitions. And these students may be correct: low-track students in course-by-course tracking might indeed be more likely to enter higher education than their low-track

counterparts in academic/vocational streaming. However, these low-track students may still be unlikely to graduate from college. Adelman (1999) found that advanced maths course work was the strongest predictor of college completion in the USA.

Policy Implications

In light of many countries' replacing academic/vocational streaming with course-by-course tracking, an important question is whether this policy change reduces social inequality in educational transitions. Although the evidence is mixed, on balance, it appears that because academic/vocational streaming is both more socio-economically segregated and more tightly linked to post-secondary destinations than course-by-course tracking, it does play a greater role than does course-by-course tracking in the reproduction of educational inequality across generations. However, the variation in outcomes across different countries with course-by-course tracking helps to identify several other important considerations. First, curricular differentiation is only one potential source of inequality in students' achievement. Results from all years of PISA show that while the association between SES and achievement is high in all academic/vocational streaming countries, this association varies across the course-by-course tracking countries. Inequality in achievement is very high in the USA, moderate in the UK and Australia and low in Canada. These differences could be due to between-school SES segregation and differences in school quality, for example due to large resource differences between families and neighbourhoods due to high income inequality, neighbourhood income segregation and/or private schooling and other forms of school choice, all of which are relatively high in Australia, the UK and the USA. Thus, reforms to systems of curricular differentiation can only go so far to reduce inequality present from other sources.

Second, although course-by-course tracking countries such as the US and UK appear to have relatively high intergenerational educational mobility (Pfeffer, 2008), they fare much worse when it comes to intergenerational mobility by income. In fact, income mobility is substantially lower in the USA and UK than in Germany (Corak, 2013). One potential explanation for the discrepancy between educational mobility and income mobility is that academic/vocational streaming gives vocational stream students opportunities for well-paid blue-collar employment. This is consistent with findings from Shavit and Müller (1998) showing that in educational systems with high vocational specificity, enrolment in vocational education increases students' chances of skilled blue collar employment and decreases their chances of unemployment. Yet it is important to note that the size of the skilled blue-collar sector varies across countries and is declining over time, and countries' levels of income inequality and income mobility also depend on redistributive tax policy, all of which are outside the scope of this chapter.

Third, the results presented above on students' university expectations and their ultimate enrolment provide insight into the influence of different types of curricular differentiation on which stage of education 'cool out' occurs, when students (often lower-achieving and/or lower-SES) give up on their aspiration to attend university. The total level of university attainment is generally higher in course-by-course tracking countries than in academic/vocational streaming countries (Buchmann and Park, 2009; Jerrim, 2014), but pathways to university completion differ across countries. In academic/vocational streaming countries, cool out appears to occur very early, at the transition into lower secondary school. In course-by-course tracking countries, cool out seems to happen later, but there is still variation across countries. In the UK, by age 15, university expectations are already quite low, suggesting that cool out occurs during lower secondary school. It appears that the majority of 15-year-old UK students who aspire to complete

university do in fact enter and graduate (Jerrim, 2014). In Australia and Canada, expectations are very high at age 15, but it appears that many of these students never enter university, suggesting that in these two countries, cool out occurs during upper secondary school or between graduation and university enrolment. However, the majority who enter university do graduate (Jerrim, 2014). Finally, in the USA, expectations are high at age 15, and college entry rates are also high, but college dropout rates are also very high (Jerrim, 2014). Thus, it appears that in the USA, cool out occurs the latest, during college.

As countries reform their systems of curricular differentiation to try to achieve greater equity, it appears that course-by-course tracking does produce lower levels of social inequality in educational transitions than does academic/vocational streaming. However, the precise design of course-by-course tracking systems has important implications for ultimate levels of inequality. Countries should monitor the effects of their systems of curricular differentiation on levels of educational aspirations and ultimate attainment.

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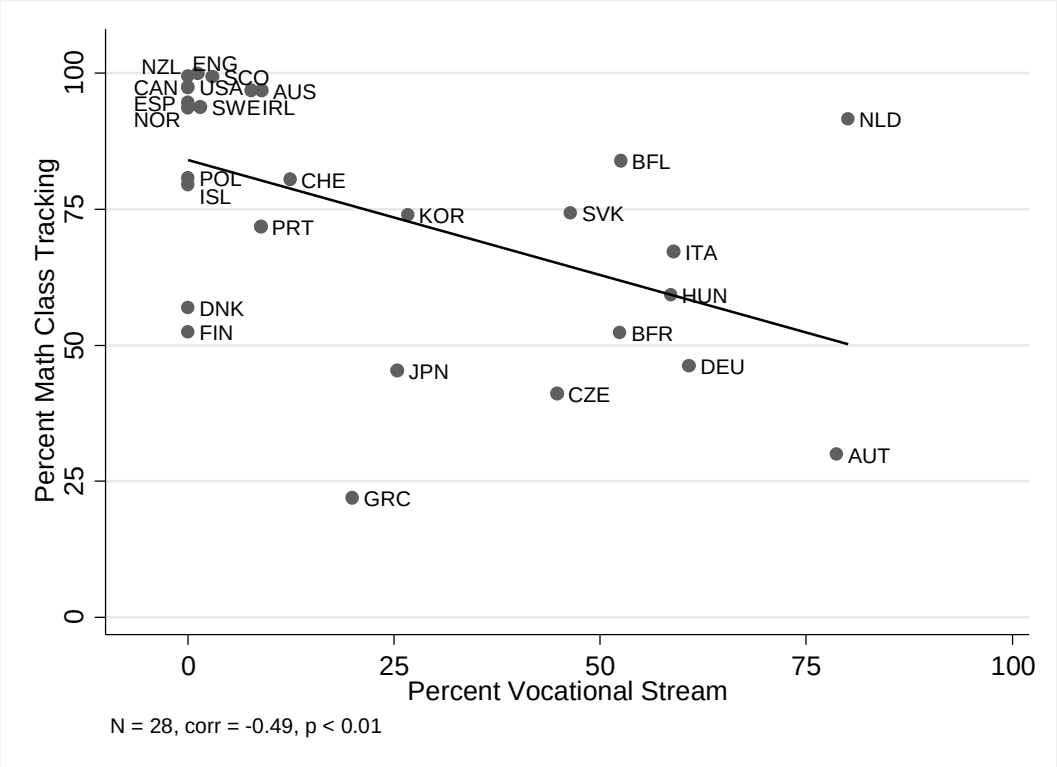
Table 1.2.1. Percent of Students in Vocational Stream and Maths Class Tracking, by Country and Type of Differentiation, PISA 2003-2015

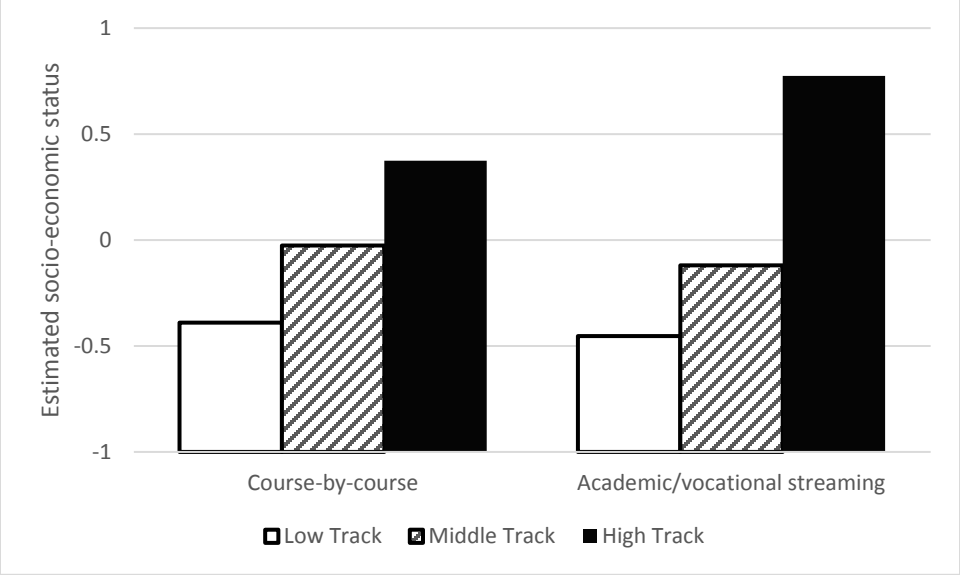
		Students in Vocational Stream							Students in Between-Class Math Tracking			
Country	Abbreviation	2003 (%)	2006 (%)	2009 (%)	2012 (%)	2015 (%)	Change 2003-2012	Average Change	2003 (%)	2012 (%)	Change 2003-2012	Average Change
Individualized integration:												
Denmark	DNK	0.00	0.00	0.00	0.00	0.07	0.00	-0.18	56.93	75.94	19.01	-7.05
Finland	FIN	0.00	0.00	0.10	0.00	0.00	0.00		52.46	64.45	12.00	
Iceland	ISL	0.00	0.06	0.00	0.00	0.00	0.00		79.50	87.11	7.61	
Norway	NOR	0.00	0.00	0.00	0.00	0.00	0.00		93.64	45.76	-47.88	
Poland	POL	0.00	0.00	0.07	0.05	0.08	0.05		80.70	57.63	-23.07	
Sweden	SWE	1.48	0.77	0.52	0.36	0.14	-1.12		93.74	83.79	-9.95	
Course-by-course tracking/A la carte integration:												
Australia	AUS	8.94	10.57	13.78	10.87	13.04	1.94	-0.34	96.86	98.41	1.55	-0.79
Canada	CAN	0.00	0.00	0.00	0.00	0.00	0.00		97.40	92.81	-4.59	
England	ENG	1.14	0.49	0.14	1.22	0.02	0.08		99.85	99.29	-0.56	
Ireland	IRL	7.66	4.85	3.95	5.95	4.97	-1.71		96.84	99.20	2.36	
New Zealand	NZL	0.00	0.00	0.00	0.00	0.00	0.00		99.36	98.70	-0.66	
Scotland	SCO	2.95	2.32	2.84	0.24	9.35	-2.71		99.27	99.15	-0.12	
United States	USA	0.00	0.00	0.00	0.00	0.00	0.00		97.42	93.94	-3.48	
Uniform integration:												
France	FRA	9.49	11.93	10.11	15.28	18.74	5.78	-0.31	missing	55.95	n/a	-1.77
Greece	GRC	19.94	13.75	13.95	13.47	16.42	-6.47		22.03	18.59	-3.44	
Italy	ITA	58.93	56.05	54.71	49.56	49.73	-9.38		67.24	75.94	8.70	
Portugal	PRT	8.83	14.03	15.87	16.65	13.14	7.82		71.78	61.65	-10.12	
Spain	ESP	0.00	0.00	0.00	0.70	0.91	0.70		94.61	92.38	-2.23	
Academic/Vocational Streaming/Separation:												
Austria	AUT	78.71	76.93	77.87	74.34	73.31	-4.37	-6.01	29.93	26.93	-3.00	6.25
Belgium-Flanders	BFL	52.52	54.98	57.22	55.07	53.31	2.55		83.88	90.10	6.22	
Belgium-French	BFR	52.38	46.24	43.89	39.85	40.08	-12.53		52.35	63.16	10.81	
Czech Republic	CZE	44.76	43.18	37.55	33.61	35.03	-11.15		41.12	40.33	-0.79	
Germany	DEU	60.77	60.75	57.82	53.81	52.48	-6.95		46.22	67.76	21.54	
Hungary	HUN	58.57	56.98	51.35	50.45	51.08	-8.12		59.22	76.71	17.50	
Luxembourg	LUX	missing	61.17	58.74	59.58	58.56	n/a		61.21	67.92	6.71	
Netherlands	NLD	80.07	78.37	78.45	74.90	70.53	-5.17		91.58	93.57	1.99	
Slovak Republic	SVK	46.44	44.25	41.22	35.52	35.13	-10.91		74.29	71.38	-2.91	
Switzerland	CHE	12.38	10.63	11.73	14.99	13.53	2.61		80.48	84.96	4.49	
Asia:												
Japan	JPN	25.39	26.07	24.94	25.04	25.44	-0.34	-3.57	45.37	63.13	17.76	16.97
Korea	KOR	26.67	23.23	24.30	19.87	16.13	-6.79		73.91	90.08	16.18	

Figure 1.2.1. Percentage of maths class tracking by percentage in vocational stream, PISA 2003



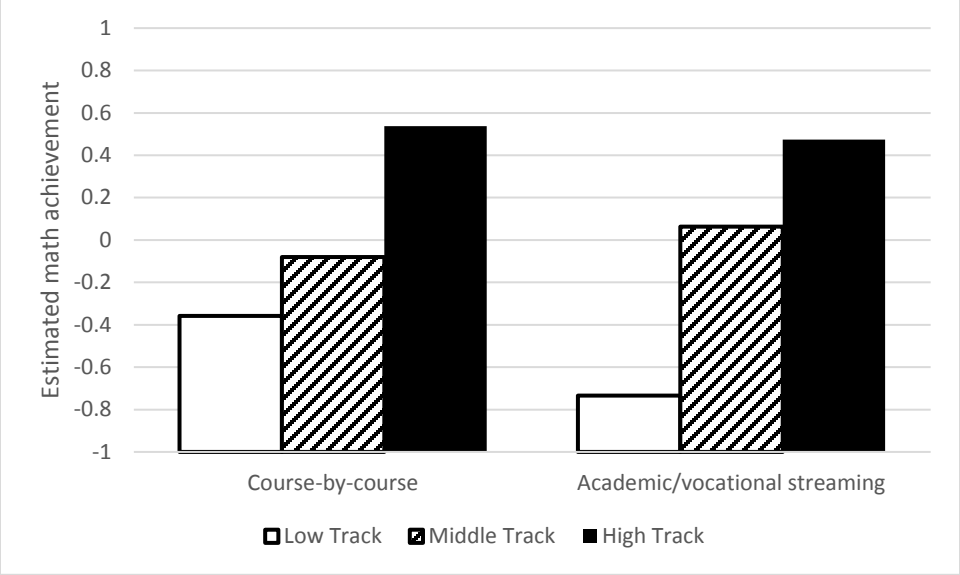
Source: New calculation using data from Chmielewski 2014. See Table 1.2.1 for abbreviations.

Figure 1.2.2. Estimated socio-economic status by track in two types of tracking



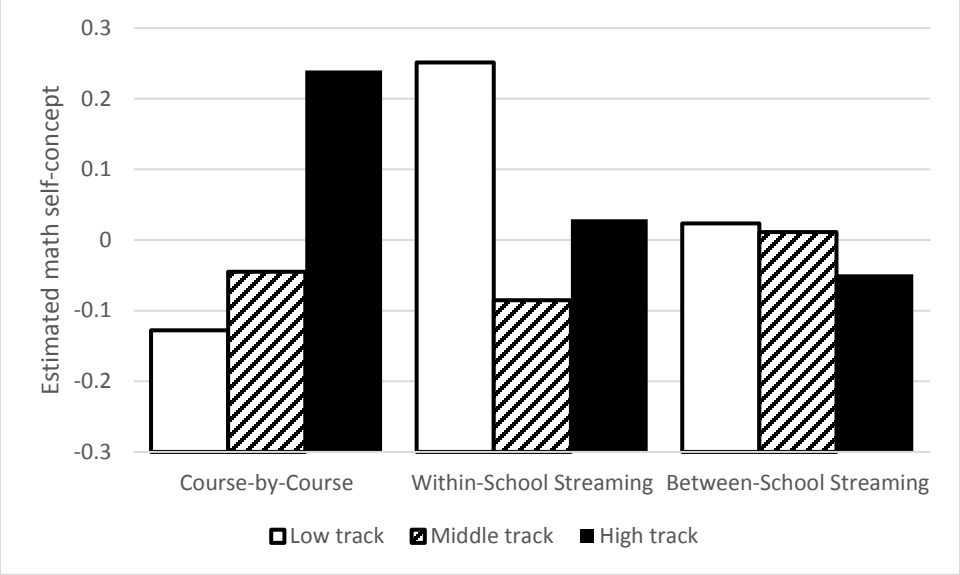
Note: SES centred within countries to approximate random effects.

Figure 1.2.3. Estimated maths achievement by track in two types of tracking



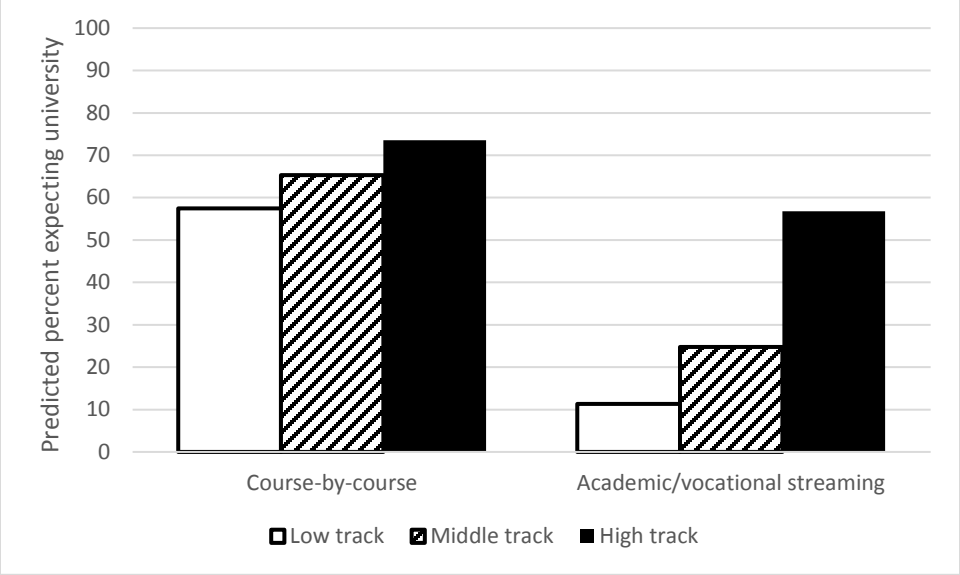
Notes: Models control for SES. Maths achievement and SES centred within countries to approximate random effects.

Figure 1.2.4. Estimated maths self-concept by track in three types of tracking



Notes: Models control for individual maths achievement and track-mean maths achievement. Maths self-concept and maths achievement centred within countries to approximate random effects.

Figure 1.2.5. Predicted university expectations by track in two types of tracking



Notes: Models control for maths achievement and SES. Maths achievement and SES centred within countries to approximate random effects.