Title: Effortless or less effort? Effects of tracks on students' engagement

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Abstract:

Background. It is found that assigning students to a lower track during secondary education negatively affects their academic performance. As an explanation, it is often mentioned that an anti-school culture in lower tracks undermines students' effort and involvement.

Aims. This study assessed whether going to a lower track affects student engagement. For if an anti-school culture is to blame for limiting lower track students' performance, lower track assignment should reduce engagement.

Sample. A sample of a longitudinal cohort study during secondary education in Flanders (northern Belgium) was used to describe development in engagement with $n = 5417$ students in 46 schools. Four tracks were investigated across four school years.

Method. Two main methodological challenges were present in this study, different student intake in each track and many students changing from a higher to lower track over time.

Accordingly, we used inverse probability treatment weights with marginal structural mean models to account for different student intake and track changes. A comparison was made per pair of tracks that are hierarchically consecutive by matching students who were comparable across these tracks. Accordingly, there were three pairwise comparisons.

Results. It was never found that being continuously in lower track negatively affects engagement. Only for one pairwise comparison there was evidence that students who changed from the higher to lower track had lower engagement.

Conclusions. We rejected the hypothesis that lower tracks negatively affect student engagement. This makes the anti-school culture as an explanation for lower track assignment negatively affecting academic performance implausible.

Keywords:

Tracking, marginal structural model, behavioural engagement, emotional engagement, vocational education

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Background

In most education systems tracking is used during secondary education (OECD, 2012, pp. 57-58), placing students into different groups called tracks according to ability and interest (e.g., Trautwein, Lüdtke, Marsh, Köller, & Baumert, 2006; Van de Werfhorst & Mijs, 2010). The assignment of students into separate tracks has been linked to increased inequality in academic performance (e.g., Van de Werfhorst & Mijs, 2010). An often cited explanation is that in lower tracks an anti-school culture exists, which limits effort and involvement, which in its turn limits learning progress in lower tracks (e.g., Carbonaro, 2005, p. 4; Van Houtte, 2016, pp. 874-875).

This study tests the anti-school culture hypothesis by assessing if being assigned to a lower track negatively affects school engagement. Inverse probability treatment weights with marginal structural mean models were used to control for differences in student intake between tracks and track changes across school years. A Flemish dataset was used for describing the development of school engagement during the first four years of secondary education. The same dataset was also used for studies on the effects of tracks on academic performance (Dockx, De Fraine, & Vandecandelaere, 2018) and academic self-concept (Dockx, De Fraine, & Vandecandelaere, 2019). However, in this

study a new year's data has been added. In the following sections, we describe literature on tracking, anti-school culture and school engagement in more detail.

Tracking

Tracking allows instructional practices to be tailored to the specific abilities and needs of more homogeneous student groups (e.g., Hanushek & Wößmann, 2006). Furthermore, it also allows for the development of specialized skillsets, which are required by the labour market (e.g., Kelly & Price, 2011; Shavit & Müller, 2000; Van de Werfhorst & Mijs, 2010). Hence, policymakers have several reasons to implement tracking at some time point during secondary education.

Two types of tracking systems are often distinguished, the early tracking system and the late tracking system (e.g., Van de Werfhorst & Mijs, 2010). The early tracking system places students in different tracks at a young age (i.e., 12 years or younger), whereas the late tracking system places students in different tracks at an older age (i.e., 14 years or older, Brunello & Rocco, 2017; Schütz, Ursprung, & Wößmann, 2008; Shavit & Müller, 2000). Usually, tracks are hierarchically organized, which leads to a distinction between higher and lower tracks, and is based on the average academic performance of students. Most studies comparing education systems have shown that education systems

with early tracking increase inequality in academic performance between students compared to education systems with late tracking (e.g., Ammermüller, 2005; Bauer & Riphahn, 2006; Brunello & Checchi, 2007; Hanushek & Wößmann, 2006; Horn, 2009; Lavrijzen & Nicaise, 2015; Marks, 2005; Schütz et al., 2008; Wößmann, 2008), but not all (e.g., Waldinger, 2007). Studies that investigated educational reform of tracking practices also find that early tracking increases inequality in academic performance (Hall, 2012; Jakubowski, Patrinos, Porta, & Wiśniewski, 2016; Kerr, Pekkarinen, & Uusitalo, 2013; Malamud & Pop-Eleches, 2011; Piopiunik, 2014). Hence, early tracking increases inequality in academic performance.

The larger inequality in academic performance in early tracking systems is typically explained by students being allocated to tracks based on their academic performance and their socioeconomic background (e.g., Erikson, Goldthorpe, Jackson, Yaish, & Cox, 2005; Jackson et al., 2007; Kloosterman, Ruiter, De Graaf, & Kraaykamp, 2009). Accordingly, studies show that students with lower academic abilities and disadvantageous socioeconomic backgrounds are placed in lower tracks, which negatively affect academic performance (e.g., Becker, Lüdtke, Trautwein, Köller, & Baumert, 2012; Guill, Lüdtke, & Köller, 2017; Gustafsson, 2008; Korthals & Dronkers, 2016; Retelsdorf,

Becker, Köller, & Möller, 2012). Using the same sample as this study, a study in Flanders also found that lower track placement negatively affects academic performance (Dockx et al., 2018). Therefore, increased inequality in academic performance is explained by the separation of student across lower and higher tracks, with lower track allocation negatively affecting academic performance. However, the exact mechanisms that lead to lower academic performance in lower tracks remain unclear.

Between education systems with explicit tracking, there are many differences. As stated in the former paragraphs, it is clear that the age of when tracking starts can differ. Other differences include whether track assignment depends on standardized tests (e.g., Bol, Witschge, Van de Werfhorst, & Dronkers, 2014; Tieben, de Graaf, & de Graaf, 2010; Trautwein et al., 2006), whether different tracks retain similarities in their curriculum or whether they are highly specialized (e.g., Shavit & Müller, 2000), whether and to what extent students can change between tracks (e.g., Akkerman, 2011; Becker et al., 2016; OECD, 2016a), and whether each class belongs to a separate track or whether each school belongs to a separate track (e.g., Trautwein et al., 2006; Van de Werfhorst & Mijs, 2010). Hence, when assessing the effects of tracks in different education systems, it should be kept in mind that the structures of tracks can differ in key characteristics.

Anti-school culture

The effects of tracks on students' outcomes are usually attributed to wide-ranging differences in learning environments provided by the different tracks. First, tracks differ in student composition, for students with different academic abilities, interests and socioeconomic backgrounds go to different tracks (Maaz, Trautwein, Lüdtke, & Baumert, 2008; Trautwein et al., 2006). Accordingly, it is assumed that the student composition of a class or schools affects student outcomes. However, not only student composition is a plausible explanation of track effects. Higher tracks are also found to be more academically challenging (e.g., Salmela-Aro, Kiuru, & Nurmi, 2008; Stevens & Vermeersch, 2010). Research has shown that cognitive activating instructions and higher levels of problem solving are more prevalent in higher tracks, whereas discipline and rote memorization are emphasized in lower tracks (Kunter & Baumert, 2006; Retelsdorf, Butler, Streblow, & Schiefele, 2010; Van Houtte, 2004). Baumert et al. (2010) also found that teachers in higher tracks have more (pedagogical) content knowledge. Note that the hypotheses on track effects in this paragraph are plausibly related, with pedagogical response resulting from classroom composition and vice versa (e.g., Gamoran, 1992; Ireson, Hallam, & Plewis, 2001).

In this paper we tested the hypothesis that lower tracks limit learning progress, because lower tracks have an anti-school culture. While there is no generally agreed upon definition of an anti-school culture, it is often described as students being opposed to the school system (e.g., Carbonaro, 2005, p. 4; Van Houtte, 2016, pp. 874-875). This is reflected in lower track students showing less effort and setting less ambitious academic goals, which limits learning progress.

The existence of an anti-school culture in lower tracks has typically been explained by using the differentiation-polarization theory (Hargreaves, 1967; Lacey, 1966). This theory states that students experience being assigned to a lower track as a failure, for this indicates that they did not meet the academic demands of the higher tracks. Accordingly, research shows that students are aware of the status of their student group (e.g., Abraham, 2008; Susan Hallam & Ireson, 2006, 2007) and consider going to a lower track as a negative choice (Ainsworth & Roscigno, 2005). Because educational attainment can no longer give status to these students, they start looking for alternative sources of status (Van Houtte, 2006a), which results in an anti-school culture.

Related to the differentiation-polarization theory is how students appraise the future rewards education can give (Van Houtte, 2006a). Lower tracks typically prepare students for less

esteemed and lower wage jobs (e.g., Brunello & Rocco, 2017; Schütz et al., 2008; Shavit & Müller, 2000), whereas higher tracks offer more pathways to higher education (e.g., Wang & Eccles, 2012; Wolbers, 2007). Hence, lower tracks students expect fewer future rewards because of education. Van Houtte (2016) indeed showed that lower track students have a higher sense of futility, the feeling of no control over success in education. In sum, an anti-school culture results from lower track students expecting fewer rewards from education.

Alternative explanations for an anti-school culture can be given as well. For example, lower tracks are more likely to attract students from disenfranchised backgrounds who may already have developed anti-school attitudes prior to track allocation. This higher prevalence of anti-school attitudes may create a compositional effect, which affects all lower track students (Müller & Hofmann, 2016). Another alternative explanation is that teachers in lower tracks have lower expectations of students and set less ambitious goals, and students will act accordingly (Abraham, 2007; Van Houtte, 2006b). Hence, this may lead to an anti-school culture as well.

Note that it could also be hypothesized that allocation to a lower track is beneficial. The big-fish-little-pond theory states that students compare themselves to other students in their school or

classroom to appraise their own academic ability. This self-appraisal is called academic self-concept (Huguet et al., 2009). Accordingly, students will appraise themselves more positively when they are allocated to a track where students have lower academic abilities instead of a track where students have higher academic abilities. There is indeed some evidence that being allocated to a lower track positively affects this academic self-concept (e.g., Arens & Watermann, 2015; Becker et al., 2014; Chiu et al., 2008; Liu, Wang, & Parkins, 2005; Mulkey, Catsambis, Steelman, & Crain, 2005; Preckel & Brüll, 2010; Trautwein, Lüdtke, Marsh, & Nagy, 2009). Using the same sample as this study, Dockx, De Fraine and Vandecandelaere (2019) also found that lower track placement generally has a positive effect on academic self-concept in Flanders. However, it is unknown whether the more positive academic self-concept caused by lower track allocation may also positively affect engagement.

In sum, an anti-school culture is often used to explain how lower tracks limit the learning progress of students. However, there are different theories on why an anti-school culture would exist in these tracks.

School engagement

The main challenge in assessing whether students have been affected by an anti-school culture is how that lack of effort and involvement should be operationalized. In educational research, the concept of school engagement is typically used to describe a student's effort and involvement. In the following paragraphs we explore this concept.

School engagement has been described as a range of attitudes and behaviours that reflect the level of involvement and effort of students in school. Engaged students seek and participate in those activities that make them successful in their learning activities (e.g., Fredricks, 2011; Johnson et al., 2001; Skinner et al., 2008, 2009). Originally, there was not one interpretation of engagement, and different constructs were assessed. Fredricks, Blumenfeld, & Paris (2004) integrated these different constructs into one three-dimensional construct of engagement, consisting of a behavioural, an emotional and a cognitive component. Behavioural school engagement refers to the level of positive behaviours and active involvement in the learning activities. This dimension has been the focus of research on student conduct and on-task behaviour. Emotional school engagement describes the student's positive emotions and attitudes towards teachers, classmates and school in general. This dimension has been the focus of research on student attitudes, interests and values.

Cognitive school engagement describes a student's level of conscious investment in the learning activities. This dimension has been the focus of research on motivational goals and self-regulated learning (e.g., Fredricks, 2011; Fredricks et al., 2004; Meece, Blumenfeld, & Hoyle, 1988; Skinner et al., 2009; Turner et al., 2002).

Note that a form of negative school engagement can be described as well, called disaffection (Skinner et al., 2009) or disengagement (Eccles, 2004). It encompasses a range of negative attitudes and behaviours such as: lack of initiation, lack of effort, mental withdrawal and giving up. It is also multidimensional with a behavioural, emotional and cognitive component. However, discussion remains whether school engagement and disaffection are on a single continuum or (partly) represent different concepts (e.g., Jimerson, Campos, & Greif, 2003).

Research has shown that school engagement outcomes generally decline through students' school careers, with the steepest declines reported during secondary education (e.g., Skinner & Pitzer, 2012; Wylie & Hodgen, 2012). This decline has been attributed to a mismatch between the developmental needs during adolescence and the educational environment (e.g., Christenson, Reschly, & Wylie, 2012; Eccles et al., 1993). Furthermore, studies have shown that during secondary education

school engagement predicts both academic performance and dropout (e.g., Archambault et al., 2009; Fall & Roberts, 2012; Fredricks et al., 2004; Green et al., 2012; Martin et al., 2012; Reschly et al., 2008; Wang & Fredricks, 2014; Wang & Holcombe, 2010). Evidence also shows that students' school engagement can be influenced by teachers and schools (Appleton, Christenson, & Furlong, 2008). Furthermore, there is evidence that supporting one of the three basic needs according to Self-Determination Theory may benefit engagement (e.g., Reeve, 2012).

This study

The goal of this study was to investigate if being allocated to a lower track negatively affects effort and involvement within the Flemish education system. This research question derived from studies on tracking which often mention that the anti-school culture in lower tracks negatively affects effort and involvement, which in its turn negatively affects academic performance. In Flanders, there is also a prevailing sentiment that going to a lower track will negatively affect engagement. However, this idea has not been empirically investigated.

Flemish education is an early tracking system where students choose freely between four tracks at age 12 (OECD, 2012, p. 57). These tracks are hierarchically organized by the average

academic abilities of students (Van Houtte, 2004). While track choice is free, students who do not meet the needs of higher track at the end of school year will be forced down the hierarchy of tracks. This change of a higher track to a lower track in the hierarchy is often described as the “educational waterfall” (Boone & Van Houtte, 2013). Accordingly, many students finish their secondary education one track lower than their initial track choice. From high to low these are the classical track, the modern track, the technical track and the vocational track. The classical and modern track mainly provide pathways to tertiary education, but they do not prepare for a transition to the labour market. The technical track offers pathways to both tertiary education and a direct transition labour market. The vocational track primarily prepares for a direct transition to the labour market. Tracks are organized at the class-level, and all classmates are in the same track.

The research question of this study was if being in a lower track in Flanders affects students’ engagement. This research question comes from the literature on tracking where lower track allocation is assumed to negatively affect students’ effort and involvement. We used school engagement measures for assessing the level of effort and involvement. We considered these to be good measures for effort and involvement, for the literature on

engagement fits the description of effort and involvement well.

Therefore, we estimated the effect of being in a lower track on engagement, compared to being in a higher track. Because students can change from a higher to lower track between school years, the effect of going to a lower track is not a single estimate. Rather, the effect of a lower track should be estimated for students who always are in the lower track and students who change to the lower track between school years.

Any estimated effect of being allocated to a lower track would be biased if we did not account for tracks attracting students with different background characteristics. On average, higher tracks attract students with higher academic performance and more advantageous socioeconomic backgrounds. Moreover, the students who change from a higher to lower track over time in Flemish education tend to be students with lower academic performance. Consequently, we used marginal structural mean models (MSMMs), a method which uses inverse probability weighting (IPW) to reweight datasets so no differences prior to initial track allocation can bias the effect. Furthermore, this method accounted for the track changes that occur in Flemish secondary education over time.

Our main hypothesis was that lower track placement negatively affects students' engagement. This was based on the idea of an anti-school culture in lower tracks. Our second hypothesis was that track change will also negatively affect engagement. This was based on the prevailing sentiment in Flemish education. In the following section, the sample and methods are described in more detail.

Sample

We used data from a study that follows a cohort of 6328 students in 48 schools (LiSO-project, 2018). A subsample was taken where students from de-tracked schools, students in a sports or arts program and students who were redoing their first year in secondary education were removed. Hence, our final subsample consisted of 5417 students. At the start of secondary education 1419 students were in the classical track, 2229 were in the modern track, 1033 students were in the technical track and 736 students were in the vocational track.

There were five measurement occasions, as shown in Figure 1: the start of secondary education September 2013 (T0), the end of the first year of secondary education May 2014 (T1), the end of the second year of secondary education May 2015 (T2), the end of the third year of secondary education May 2016 (T3), and the end of the fourth year of secondary education May 2017 (T4).

[Figure 1]

Variables

Treatment variable

The treatment variable was track allocation (Z_t). Pairwise comparisons were made between tracks that are consecutive in the hierarchy of tracks. It was not possible to compare nonconsecutive tracks, due to the absence of comparable students (this will be further explained in the section ‘Weighting procedure’). Lower track allocation was the active treatment condition ($Z_t = 1$), whereas higher track allocation was the control condition ($Z_t = 0$). Three comparisons were made: the classical track with the modern track, the modern track with the technical track, and the technical track with the vocational track. For each comparison of two tracks five track allocation histories were distinguished: staying in the higher track continuously (0,0,0,0), starting in the higher track but changing to the lower track after T3 (0,0,0,1), starting in the higher track but changing to the lower track after T2 (0,0,1,1), starting in the higher track but changing to the lower track after T1 (0,1,1,1) and staying in the lower track continuously (1,1,1,1).

Outcomes

School engagement was operationalized with a measure for behavioural school engagement and a measure for emotional school engagement. Multiple group factor analyses were used to investigate measurement invariance across measurement occasions (Baumgartner & Steenkamp, 2006; Cheung & Rensvold, 2002). This implied assessing whether factor loadings and means of the indicators can be held equal over time and across tracks with sufficient model fit. The cutoff criteria from Hu and Bentler's (1999) were used for fit indices CFI, TLI and RMSEA.

Behavioural school engagement was measured with five items, and emotional school engagement was measured with four items. Both measures were part of a student questionnaire which was conducted at T0, T1, T2, T3 and T4. The items were Dutch translations of the items of an English measure (Skinner et al., 2009). Factor analyses showed that a one-factor structure with assumed measurement invariance fitted well for behavioural school engagement and no item loading or intercept had to be unconstrained (CFI= .97, TLI = .97, RMSEA = .06). For emotional school engagement one item intercept had to be unconstrained at T0 to achieve satisfactory model fit (CFI = .98, TLI = .98, RMSEA = .05). Composite reliabilities ranged from 0.78 to 0.85 for behavioural school engagement, for emotional school engagement

they ranged from 0.78 to 0.80. Maximum a posteriori (MAP) estimation was used for student factor scores with a zero mean and unit variance.

Independent variables

To procure unbiased estimates of track effects we needed to account for all differences between students that predict both track change and the outcome at each time point. In literature on MSMMs this is referred to as the sequential conditional exchangeability assumption (Robins & Hernán, 2009). Most authors agree that all variables that predict both the treatment (i.e., track allocation and track change in this study) and the outcome (i.e. school engagement in this study) should be included. If sample size allows it, all variables related to the outcome should also be included (e.g., Brookhart et al., 2006; Myers et al., 2011; Stuart, 2010). Hence, we included those variables that predict school engagement, the initial track allocation and track changes. We used 25 variables, which are discussed in the following paragraphs and shown in Table 1.

[Table 1]

Academic performance

Three measures of academic performance were used: a mathematics test, a Dutch reading comprehension test and a French test. Each test consisted of multiple-choice items and open questions. Item Response Theory (IRT) with 2-parameter and 3-parameter models was used. Warm's weighted likelihood estimation (Warm, 1989) was used for estimating student ability scores. Mathematics tests were conducted at T0, T1, T2 and T3 with the Cronbach's Alphas ranging from 0.83 to 0.87. A Dutch reading comprehension test was conducted at T0 with a Cronbach's Alpha of 0.82. A French test was conducted at T0 with a Cronbach's Alpha of 0.79.

Biographical background

Two variables from governmental records were used. The first variable indicates whether the student is a boy. The second variable indicates whether the student is older than normally progressing students.

Socioeconomic background

Socioeconomic status was modeled with a Nominal Response Model (Bock, 1972) based on seven indicators: (1 & 2) diploma father and diploma mother, (3 & 4) employment status father and employment status mother, (5 & 6) occupational level father and occupational level mother and (7) family income. These

indicators were acquired from a parent questionnaire conducted at T0. Expected A Posteriori (EAP) estimation was used for computing factor scores with an empirical reliability of 0.87.

Three variables from governmental records were also used. The first variable indicates whether a student's family is eligible for a governmental financial grant due low family income. The second variable indicates whether the mother has not attained a diploma of secondary education. The third variable indicates whether the student does not speak Dutch with more than one family member.

Psychosocial development

For psychosocial development repeated measurements of engagement, disengagement, academic self-concept, motivation, mindset, school wellbeing and interest were conducted at T0, T1, T2 and T3 with a student questionnaire. All these measures were on a five-point response scale, which ranged from “not true” to “true”. Most were Dutch translations of English measures. MAP estimation was used for student factor scores.

Behavioural and emotional school engagement were already discussed in the outcomes section. Behavioural disengagement and emotional disengagement were also assessed. These originated from the same source as the engagement measures (Skinner et al., 2009). Academic self-concept was assessed with measures for global academic self-concept and domain-specific self-concepts for mathematics, Dutch and French. These came from the Self-Description Questionnaire III (Marsh & O'Neill, 1984) and shortened Self-Description Questionnaire II (Marsh, Ellis, Parada, Richards, & Heubeck, 2005). Composite reliabilities ranged from 0.77 to 0.84 for general academic self-concept, from 0.89 to 0.92 for self-concept in mathematics, and from 0.85 to 0.88 for self-concept in Dutch. Student motivation was assessed with measures for controlled motivation and autonomous motivation. These came from the Academic Self-Regulation Questionnaire (SQR-A, Ryan & Connell, 1989). Composite reliabilities ranged from 0.74 to 0.78 for controlled motivation, and from 0.78 to 0.81 for autonomous motivation. Mindset was assessed with the Theory of Intelligence Scale (Dweck, Chiu, & Hong, 1995). The composite reliability of mindset ranged from 0.55 to 0.73. School wellbeing was assessed with a measure of Dutch origin (Vorst & Smits, 2010). The composite reliability of school wellbeing ranged from 0.80

to 0.85. Interest was assessed for mathematics, Dutch, French and technology (Denissen, Zarrett, & Eccles, 2007). Spearman-Brown Coefficients ranged from 0.83 to 0.91 for interest in mathematics, from 0.81 to 0.88 for interest in Dutch, from 0.86 to 0.88 for interest in French, and from 0.92 to 0.96 for interest in technology. Marginal structural mean model

Background

The goal of a marginal structural model (e.g., Vandecandelaere, Vansteelandt, De Fraine, & Van Damme, 2016) is to construct comparable groups of respondents (i.e., students) across treatment conditions (i.e., attending the higher track or the lower track) at each time point that a treatment exposure can occur (i.e., track changing between school years). To achieve this, inverse probability treatment weighting (IPTW; Austin, 2011) is used. IPTW's main rationale is that when estimating the treatment probabilities on a set of covariates, the estimated probabilities summarize the pretreatment differences in covariates between treatment conditions (Imbens, 2000, p. 708; Rosenbaum & Rubin, 1983). By weighting with the inverse of these probabilities each treatment condition is made to resemble the population prior to the treatment exposure. Accordingly, the MSMM estimates the average outcome if the entire population would have been

allocated to a certain treatment history. This estimated average outcome is called the marginal mean (Robins & Hernán, 2009).

The application of a MSMM to estimate the marginal means of each treatment history consists of three main steps (e.g., Vandecandelaere, et al., 2016). First, a structural model for the marginal means is defined. Second, weights are estimated. Third, a Horvitz-Thompson type estimator with the weights is used for estimating the structural model. The differences between the marginal means of the structural model are unbiased if the sequential conditional exchangeability assumption holds (Robins & Hernán, 2009). We describe each of these steps in the following sections.

Structural model

As a first step of applying the MSMM we linked the marginal mean of each treatment history to a structural model. The marginal mean here is either behavioural school engagement or emotional school engagement. For the marginal mean at measurement occasion T4 we have the following equation:

$$\begin{aligned} E[Y_4(z_1, z_2, z_3, z_4)] = & \beta_0 + \beta_1 z_1 z_2 z_3 z_4 + \\ & \beta_2 (1 - z_1) z_2 z_3 z_4 + \beta_3 (1 - z_1) (1 - z_2) z_3 z_4 + \\ & \beta_4 (1 - z_1) (1 - z_2) (1 - z_3) z_4 \quad (1) \end{aligned}$$

In this equation $E[Y_4(z_1, z_2, z_3, z_4)]$ is the marginal mean, and parameters β_1 , β_2 , β_3 and β_4 respectively describe the average

treatment effects of track allocation histories (1,1,1,1), (0,1,1,1), (0,0,1,1) and (0,0,0,1). β_0 is therefore equal to the track allocation history of always being in the higher track (0,0,0,0). Note that for the marginal means at measurement occasions T1, T2 and T3 equivalent structural models were specified.

Weighting procedure

The second step of applying the MSMM was the estimation of weights in order to remove pretreatment differences across treatment conditions. There were four time points of treatment exposure: T1, T2, T3 and T4. Accordingly, for each time point a time-specific weight was estimated. The total weight at T4, $\overline{SW}_4$, therefore was the product of time-specific weights, which are both described the following equation:

$$\begin{aligned} \overline{SW}_4 &= SW_1 * SW_2 * SW_3 * SW_4 = \\ &\frac{P[Z_1=1]}{P[Z_1 = 1|x_0]} * \frac{P[Z_2 = 1|Z_1 = 0]}{P[Z_2 = 1|x_0, l_1, Z_1 = 0]} * \\ &\frac{P[Z_3 = 1|Z_2 = 0]}{P[Z_3 = 1|x_0, l_2, Z_2 = 0]} * \frac{P[Z_4 = 1|Z_3 = 0]}{P[Z_4 = 1|x_0, l_3, Z_3 = 0]} \quad (5) \end{aligned}$$

In this equation $\overline{SW}_4$ was the total weight at T4, and SW_1 , SW_2 , SW_3 and SW_4 were the time-specific stabilized weights. Each time-specific weight was estimated based on the baseline measure of the covariates measured at T0 (x_0) and the repeated measures of the time-varying covariates (l_{t-1}) measured prior to the track change. When a time-specific weight was not estimated for a

student (i.e., student was already in the lower track), it was replaced by value one (i.e. the total weight is unchanged). Note that for the total weights $\overline{SW}_1$, $\overline{SW}_2$ and $\overline{SW}_3$ at T1, T2 and T3 respectively, it was only necessary to multiply time-specific weights until that measurement occasion.

Before estimating weights, we assessed the area of common support between the different track allocation histories of a track comparison. This was achieved by estimating the propensity score of being continuously in the higher track. The overlap in the resulting propensity scores were then used to assess the area of common support (Steiner & Cook, 2013). To prevent extreme weights, students with probabilities close to either one or zero were removed from the sample prior to estimating weights. We used a minimum of 0.05 and a maximum of 0.95 as cutoff values (e.g., Crump, Hotz, Imbens, & Mitnik, 2009). This step will be shown first in the results section.

Furthermore, to attain stable weights estimates we chose not to use the entire history of time-varying covariates, but only their values at T0 (i.e., the baseline measures) and their values directly prior to the track allocation. This appeared to be enough to balance the entire covariate history and stabilize the weight estimation. To estimate the propensity score we used generalized boosted regression models (GBMs, McCaffrey, Ridgeway, &

Morral, 2004), which is considered best practice for propensity score estimation (e.g., Stuart, 2010). However, for the technical and vocational track comparison we used the covariates as linear predictors, for this lead to a better balance. We also used 99th percentile truncation (e.g., Lee, Lessler, & Stuart, 2011). The *twang* 1.5 package (Ridgeway, McCaffrey, Morral, Griffin, & Burgette, 2017) in R 3.4.3 was used for weight estimation.

We assessed balance in the covariates after applying the weights with standardized mean differences of covariates (SMDs). The SMD is the difference between two covariate means of track allocation histories, divided by the pooled *SD* of both track allocation histories (Rubin, 2001). The SMDs were assessed before and after applying weights. Mean SMDs should be no higher than 0.05 while SMDs of specific covariates as a rule of thumb should not exceed 0.25 (Caliendo & Kopeinig, 2008).

Estimation

The third step of applying the MSMM was fitting the structural models as a generalized linear model. The model is estimated with the time-varying outcome on the left hand-side, and the combination of treatment-history indicators with time point indicators on the right-hand side. We used GEEs with the Newton-Raphson algorithm and specified an independent correlation matrix (Liang & Zeger, 1986) with sandwich standard errors (Joffe, Ten

Have, Feldman, & Kimmel, 2004). Using a non-independent correlation structure or multilevel models would bias results by making outcome measurements dependent on future treatment exposures (Robins, Hernan, & Brumback, 2000, p. 554). To examine differences between track allocation histories at each time point, contrasts were tested using one degree of freedom Wald tests (Kuhn, Weston, Wing, & Forester, 2016). The geepack 1.2-1 package in R 3.4.3 was used for estimation (Højsgaard, Halekoh, & Yan, 2006). Cohen's d was used for effect size interpretation (Cohen, 1977).

Missing values

The rates of missingness for the track allocation histories of interest were 2.98%, 14.17%, 8.18%, 12.86%, and 15.87% (only outcomes) at T0, T1, T2, T3 and T4 respectively. We used multiple imputation by chained equations for missing values in the outcomes and covariates (Schafer & Graham, 2002) with the package mice 2.30 (van Buuren & Groothuis-Oudshoorn, 2011) in R 3.4.3. This should result in unbiased and efficient estimates under the missing at random assumption (MAR, e.g., Moodie, Delaney, Lefebvre, & Platt, 2008). We estimated ten imputed datasets, and combined the results as described by Rubin's (1987) rules. The average relative efficiencies for contrasts at T4 was 99.12% for the classical and modern track comparison, 98.23% for

the modern and technical track comparison, and 97.59% for the technical and vocational track comparison.

There were also students who did not have a track allocation history as described in the ‘Treatment variable’ section, but at some time point went to a sports program, arts program, special method program, special education, changed track multiple times or changed to a track not part of the comparison. Simply removing these students from the analysis could bias results. Therefore, these students were included in the analysis up until the time point they went to an alternative track allocation history, from that time point they were considered censored. Censoring weights for these students were estimated just as IPTW for the MSMM, but now the probability of being censored was estimated. The final weights used in the analysis were a product of the IPTW weights and censoring weights.

Results

Balance after weighting

Figure 2 shows the overlap in logit propensity scores of higher track allocation between track allocation histories of each comparison. Substantial overlap exists, but for each comparison very low propensity scores and very higher propensity scores occurred. Accordingly, by applying the cut-off values of .05 and .95, students were removed from the dataset. The resulting

sample size for each comparison across time points is shown in Table 2.

[Figure 2]

[Table 2]

Figures 3, 4 and 5 show the absolute SMDs for each track comparison. Note that in the first panel of Figure 5, the unweighted absolute standardized mean difference for mathematics at T0 exceeds the x-axis' limit, for it had a value of 1.47. Table 3 shows the mean, minimum, and maximum of all SMDs after applying the weights. The results show a substantial reduction in the pretreatment differences between tracks. For the classical and modern track comparison, general academic self-concept measured direct prior to a track allocation slightly exceeds the .25 cutoff value at T1, T2 and T3. The same is observed for the modern and technical track comparison, however at T4 there is remaining imbalance in mathematics self-concept and also mathematics performance. For the technical and vocational track comparison, imbalance remains for interest in technology and gender at T2 and T3. At T4 imbalance remains for self-concept in mathematics and mathematics performance.

[Table 3]

[Figure 3]

[Figure 4]

[Figure 5]

Analysis of track effects

In the following paragraphs we describe the estimated contrasts across the three track comparisons. For brevity, we limit the description to general trends and the final contrast estimates at T4. Figures 6, 7 and 8 also show the development in behavioural school engagement and emotional school engagement for each track comparison. Note that across all outcomes and across all groups we only observe declines. Accordingly, we will describe whether the different groups of students decline more than the reference group, which is the group of students continuously in the higher track. The estimated contrasts are shown in Table 4, 5 and 6.

Classical and modern track comparison

For behavioural school engagement we see no substantial difference in the development between the group of students

continuously in the higher track and the group of students continuously in the lower track. Hence, at T4 the contrast is not significant. The groups of students who changed from the higher to lower track do decline more. However, only the group of students who changed from the higher to lower track after T1 has a significant contrast at T4, but it has a trivial effect size.

For emotional school engagement we see no substantial difference in the development between the group of students continuously in the higher track and the group of students continuously in the lower track. Hence, at T4 the contrast is not significant. The groups of students who changed from the higher to lower track do decline more. Accordingly, the group of students who changed from the higher to lower track after T1 and the group of students who changed from the higher to lower track after T2 have significant contrasts at T4 with small effect sizes.

[Table 4]

[Figure 6]

Modern and technical track comparison

For behavioural school engagement there is no substantial difference in the development between the group of students

continuously in the higher track and the group of students continuously in the lower track. Hence, at T4 the contrast is not significant. The groups of students who changed from the higher to lower track do decline more. However, only the group of students who changed from the higher to lower track after T2 has a significant contrast at T4, but it has a trivial effect size.

For emotional school engagement the group of students continuously in the lower track declines slightly more than the group of students continuously in the higher track. However, at T4 the contrast is not significant. Only the group of students who changed from the higher to lower track after T1 decline slightly more. Hence, at T4 their contrast is significant but with a trivial effect size.

[Table 5]

[Figure 7]

Technical and vocational track comparison

For behavioural school engagement there are some differences in the development between the group of students continuously in the higher track (technical track) and the group of students continuously in the lower track (vocational track), but at

T4 no difference remains. Hence, at T4 the contrast is not significant. The groups of students who changed from the higher to lower track also show some difference in their development, but at T4 no differences remain.

For emotional school engagement there are some difference in the development between the group of students continuously in the higher track and the group of students continuously in the lower track, but at T4 no difference remains. Accordingly, at T4 the contrast is not significant. The groups of students who changed from the higher to lower track also show some difference in their development, but at T4 no differences remain.

[Table 6]

[Figure 8]

Summary

In sum, for the classical and modern track comparison we find that students who changed from the higher to lower track generally decline more in emotional school engagement. There is no substantial difference for behavioural school engagement. Students continuously in the classical track and modern track do not differ for both outcomes. For the modern and technical track

comparison we find no substantial differences between student groups. Accordingly, for the technical and vocational track comparison we find no substantial differences between student groups.

Discussion

In this study we investigated whether being assigned to the lower track, either from the start of secondary education or after a track change, affects school engagement. Behavioural and emotional school engagement were compared between four tracks. Students were compared across pairs of tracks that were hierarchically consecutive, which lead to three pairwise track comparisons.

We generally do not find support for our hypothesis. Only for one out of three pairwise track comparisons we find evidence that students who start in the higher track but change to the lower track have lower school engagement than comparable students continuously in the higher track. However, there is never evidence that students continuously in the lower track have lower school engagement than comparable students in the higher track. Therefore, the hypothesis is rejected.

This finding is surprising given that an anti-school culture is often used as an explanation for lower tracks negatively affecting academic performance (e.g., Abraham, 2008; Müller & Hofmann,

2016; Van Houtte, 2006a). However, it should be noted that we assessed behavioural and emotional school engagement as an operationalization of anti-school norms. Behavioural school engagement describes the level of active involvement in the learning activities and emotional school engagement describes the positive emotions a student has toward to teachers, classmates and school in general. Contrarily, Van Houtte and Stevens (2015) measured the sense of futility, which can be defined as not believing it is possible to influence one's own success at school. Hence, a difference in operationalization may be the cause for the rejection of our hypothesis.

Our results are similar to the results of Dumont, Protsch, Jansen and Becker (2017), who investigated the effects of tracks on disengagement with the Maslach Burnout Inventory cynicism scale. Because students from the same track could receive different certificates, they could distinguish between the effect of the track as a social context and the effect of a certificate. The students were assessed just before they entered the labour market. Generally, they found that, given the same certificate, the track as a social context does not affect students' cynicism.

However, if anti-school culture cannot explain why lower tracks negatively affect academic performance, alternative explanations become more plausible. For example, higher tracks

have more learning opportunities that are both cognitively challenging and supported by adaptive teacher feedback, whereas lower tracks are more characterized by rote memorization and the disciplining of students (e.g., Baumert et al., 2010; Kunter & Baumert, 2006; Retelsdorf, Butler, Streblow, & Schiefele, 2010; Van Houtte, 2004). Accordingly, lower track are considered less academically challenging than higher tracks (e.g., Salmela-Aro, Kiuru, & Nurmi, 2008; Stevens & Vermeersch, 2010). In Germany teachers were also found to have more pedagogical content knowledge in higher tracks (Baumert et al., 2010; Krauss et al., 2008). Hence, alternative explanations of lower tracks negatively affecting academic performance are possible.

Note that these findings may only be applicable to Flanders. While earlier we solely distinguished tracking systems by the age when tracking starts, this is an oversimplification. Many aspects of tracking systems can differ across education systems such as whether the tracks are strongly specialized or retain general skills development (e.g., Shavit & Müller, 2000), the number of tracks (e.g., Bol & van de Werfhorst, 2013), whether standardized tests determine assignment of students to tracks (e.g., Bol, Witschge, Van de Werfhorst, & Dronkers, 2014; Tieben, de Graaf, & de Graaf, 2010; Trautwein et al., 2006) and whether tracks are organized on the school-level or class-level (e.g., Trautwein et al.,

2006; Van de Werfhorst & Mijs, 2010). Hence, tracking systems can differ substantially and this could affect the effects of a lower track on school engagement.

Strengths and limitations

A limitation of this study is that school engagement is only assessed for the behavioural and emotional component. This is a somewhat narrow operationalization of school engagement (e.g., Fredricks, 2011), for the cognitive component and disaffection are not included. However, keen readers will have noted that we have used behavioural disaffection and emotional disaffection as controls (Table 1). These measures were found to be unreliable and had only partial measurement invariance and we decided not to present their results here. However, we did estimate the effect of lower track allocation on these disaffection measures at T4, which gave highly similar results as the school engagement measures. In our view, this indicated that the inclusion of disaffection measures would be of too limited value. The lack of a measure for cognitive school engagement is more problematic, given that it can act differently than emotional and behavioural school engagement (e.g., Wang & Eccles, 2012).

Any estimate in this study is based on the assumption the no covariates remain that predict both lower track allocation and the school engagement (e.g., Rosenbaum & Rubin, 1983). This

assumption can never be tested (Steiner & Cook, 2013). We argue though that by accounting for indicators of academic performance, socioeconomic background and psychosocial variables most bias should have been removed. Furthermore, unobserved variables that are correlated with the accounted for variables (Stuart, 2010) are accounted for as well.

The estimates in our study are limited to the area of common support between compared groups (e.g., Stuart, 2010). Our inferences can only apply to a population of students who are adequately represented in each group. Therefore, we only compared track allocation histories between tracks which are consecutive in the hierarchy of tracks. When comparing pairs of tracks, it was also necessary to remove respondents with very high and very low propensities prior to applying both methods. Accordingly, an estimate in this study should not be interpreted as the average effect as if the entire population was in a specific group.

Also note that the inferences in this study can not be simply generalized to other education systems. Tracks in Flemish education have unique characteristics, which may affect the outcomes of this study. Therefore, in other education systems different effects could be found. The only other study that shows

that tracks do not affect engagement is the study of Dumont et al. (2017) in Germany.

Conclusion

In sum, we do not find that the assignment of students to a lower track affects school engagement. In addition, we only find limited evidence that changing from a higher to a lower track has a negative effect on school engagement. Therefore, In Flanders, the hypothesis that an anti-school culture causes lower tracks to negatively affect students' engagement is untenable.

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Table 1

Descriptions, information sources and properties of time-varying and time-fixed confounder measures

Variable	Description	Info	T0	T1	T2	T3	T4
Mathematics	IRT-score achievement in mathematics	AT	X	X	X	X	
Dutch	IRT-score achievement in Dutch reading comprehension	AT	X				
French	IRT-score achievement in French	AT	X				
Gender	Indicator for boy	OR	X				
Age	Indicator whether student is older than normally progressing	OR	X				
SES	Factor score socioeconomic status	PQ	X				
Allowance	Indicator whether family has an allowance due to low income	OR	X				
Education mother	Indicator whether mother is lowly educated	OR	X				
Other language	Indicator whether the home language is not Dutch	OR	X				
Global self-concept	Factor score global academic self-concept	SQ	X	X	X	X	
Self-concept mathematics	Factor score self-concept mathematics	SQ	X	X	X	X	
Self-concept Dutch	Factor score self-concept Dutch	SQ	X	X	X	X	
Self-concept French	Factor score self-concept French	SQ	X	X	X		

Variable	Description	Info	T0	T1	T2	T3	T4
Wellbeing	Factor score wellbeing	SQ	X	X	X	X	
Mindset	Factor score mindset	SQ	X	X	X	X	
Autonomous motivation	Factor score autonomous motivation	SQ	X	X	X	X	
Controlled motivation	Factor score controlled motivation	SQ	X	X	X	X	
Behavioural engagement	Factor score behavioural engagement	SQ	X	X	X	X	X
Emotional engagement	Factor score emotional engagement	SQ	X	X	X	X	X
Behavioural disengagement	Factor score behavioural disengagement	SQ	X	X	X	X	
Emotional disengagement	Factor score emotional disengagement	SQ	X	X	X	X	
Interest mathematics	Sum score interest in mathematics	SQ	X	X	X	X	
Interest Dutch	Sum score interest in Dutch	SQ	X	X	X	X	
Interest French	Sum score interest in French	SQ	X	X	X		
Interest technology	Sum score interest in technology	SQ	X	X	X	X	

Note: T0 = measured at T0; T1 = measured at T1; T2 = measured at T2; T3 = measured at T3; T4 = measured at T4; AT = achievement

test; OR = official records; PQ = parent questionnaire; SQ = student questionnaire

Table 2

Overview treatment histories of classical and modern track comparison, modern and technical track comparison, and technical and vocational track comparison

Treatment history	T1	T2	T3	T4
<u>Classical and modern track comparison</u>				
Classical track continuous (0,0,0,0)	1240	978	673	608
Classical to modern after T3 (0,0,0,1)				61
Classical to modern after T2 (0,0,1,1)			291	281
Classical to modern after T1 (0,1,1,1)		242	223	196
Modern track continuous (1,1,1,1)	955	881	728	652
To other program		94	280	397
<u>Modern and technical track comparison</u>				
Modern track continuous (0,0,0,0)	2182	1780	1304	1078
Modern to technical track T3 (0,0,0,1)				187
Modern to technical track T2 (0,0,1,1)			338	315
Modern to technical track T1 (0,1,1,1)		284	219	192
Technical track continuous (1,1,1,1)	887	691	586	541
To other program		314	622	756
<u>Technical and vocational track comparison</u>				
Technical track continuous (0,0,0,0)	1026	772	645	588
Technical to vocational track T3 (0,0,0,1)				44

Treatment history	T1	T2	T3	T4
Technical to vocational track T2 (0,0,1,1)			89	86
Technical to vocational track T1 (0,1,1,1)		162	143	139
Vocational track continuous (1,1,1,1)	544	497	473	454
To other program		139	220	259

Note: T1 = Number of students first year after removal extreme propensity scores; T2 = Number of students second year after removal extreme propensity scores; T3 = Number of students third year after removal extreme propensity scores; T4 = Number of students fourth year after removal extreme propensity scores

Tables

Table 3

SMDs after weighting

	Classical and modern				Modern and technical				Technical and vocational			
	track comparison				track comparison				track comparison			
	T1	T2	T3	T4	T1	T2	T3	T4	T1	T2	T3	T4
Average	-.03	-.03	-.03	-.03	-.02	-.06	-.05	-.04	.03	-.06	-.06	-.04
Minimum	-.17	-.30	-.30	-.27	-.15	-.32	-.30	-.32	-.25	-.41	-.35	-.32
Maximum	.09	.18	.18	.19	.11	.18	.19	.20	.18	.12	.10	.26

Note: SMD = standardized mean difference

Table 4

Contrast estimates behavioural engagement and emotional engagement in classical and modern track comparison

	Behavioural engagement		Emotional engagement	
	<i>d</i>	SE	<i>d</i>	SE
T1				
High – low	-0.06	0.04	0.07	0.04
T2				
High – low	0.02	0.05	0.05	0.04
High – T1 Change	0.15	0.09	0.21*	0.07
T3				
High – low	-0.01	0.07	0.09	0.05
High – T1 Change	0.27*	0.09	0.28*	0.07
High – T2 Change	0.18*	0.09	0.15*	0.07
T4				
High – low	0.00	0.07	0.06	0.06
High – T1 Change	0.19*	0.09	0.28*	0.08
High – T2 Change	0.17	0.09	0.23*	0.08
High – T3 Change	0.14	0.15	0.19	0.14

Note: *d* = contrast estimate; high = continuously in the higher track; low = continuously in the lower track; T1 change = changed from higher to lower track after T1; T2 change = changed from higher to lower track after T2; T3 change = changed from higher to lower track after T3

Table 5

Contrast estimates behavioural engagement and emotional engagement in modern and technical track comparison

	Behavioural engagement		Emotional engagement	
	<i>d</i>	SE	<i>d</i>	SE
T1				
High – low	-0.03	0.04	0.01	0.04
T2				
High – low	-0.03	0.05	0.07	0.04
High – T1 Change	0.20*	0.09	0.08	0.07
T3				
High – low	-0.01	0.06	0.08	0.06
High – T1 Change	0.09	0.10	0.11	0.08
High – T2 Change	0.08	0.08	-0.04	0.07
T4				
High – low	0.03	0.07	0.12	0.06
High – T1 Change	0.19	0.11	0.18*	0.09
High – T2 Change	0.17*	0.08	0.01	0.08
High – T3 Change	0.07	0.11	0.03	0.09

Note: *d* = contrast estimate; high = continuously in the higher track; low = continuously in the lower track; T1 change = changed from higher to lower track after T1; T2 change = changed from higher to lower track after T2; T3 change = changed from higher to lower track after T3

Table 6

Contrast estimates behavioural engagement and emotional engagement in technical and vocational track comparison

	Behavioural engagement		Emotional engagement	
	<i>d</i>	SE	<i>d</i>	SE
T1				
High – low	0.07	0.10	-0.01	0.11
T2				
High – low	0.22*	0.10	0.18*	0.08
High – T1 Change	0.38	0.26	0.18	0.23
T3				
High – low	-0.10	0.12	-0.03	0.10
High – T1 Change	0.17	0.15	0.15	0.13
High – T2 Change	-0.31	0.31	-0.30	0.23
T4				
High – low	-0.11	0.13	0.04	0.12
High – T1 Change	-0.16	0.16	-0.10	0.14
High – T2 Change	-0.16	0.16	-0.13	0.13
High – T3 Change	0.05	0.44	0.07	0.24

Note: *d* = contrast estimate; high = continuously in the higher track; low = continuously in the lower track; T1 change = changed from higher to lower track after T1; T2 change = changed from higher to lower track after T2; T3 change = changed from higher to lower track after T3

Timeline assessment occasions and school years.

Figure 1.

Overlap in logit propensity scores for higher track allocation across treatment histories of each track comparison.

Figure 2.

SMDs classical and modern track comparison at T1, T2, T3 and T4.

Figure 3.

SMDs modern and technical track comparison at T1, T2, T3 and T4.

Figure 4.

SMDs technical and vocational track comparison at T1, T2, T3 and T4.

Figure 5.

Development behavioural engagement and emotional engagement in classical and modern track comparison.

Figure 6.

Development behavioural engagement and emotional engagement in modern and technical track comparison.

Figure 7.

Development behavioural engagement and emotional engagement in technical and vocational track comparison.

Figure 8.