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Human Agency in Educational Trajectories: Evidence from a Stratified System

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Abstract

In the research on life-course outcomes, there is a long-standing debate on the relative importance of institutional structure and human agency. This study examines how structure and agency influence educational trajectories in Switzerland. The Swiss education system is hierarchically differentiated but permeable, providing both standard and nonstandard pathways to higher education. Using data from a 15-year panel survey, the study assesses, first, the extent to which lower-secondary-school track attendance is associated with individuals' probability of moving into an academic or vocational program at upper-secondary level and, second, how this predicts the probability of subsequently entering a university. The study also examines how human agency influences these probabilities. Results of a structural equation model show that lower-secondary track attendance significantly predicts individuals' probability of transitioning into academic education, whereas human agency plays a minor, albeit nonnegligible, role in this regard. In turn, pursuing an academic rather than a vocational program is associated with a 47-percentage-point (or sixteen-fold) higher probability of subsequently attending university. Individuals comparatively rarely follow nonstandard pathways to university, irrespective of their level of agency. The education system channels educational trajectories, but the power of the channeling effect varies across the different junctures of the system.

Keywords

Structure/agency; life course; tracking; academic achievement; social psychology; stratification; micro and macro mechanisms

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Institutional Review Board approval

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HUMAN AGENCY IN EDUCATIONAL TRAJECTORIES: EVIDENCE FROM A STRATIFIED SYSTEM

Education systems have been conceived of as sorting machines (Spring, 1976) because they channel educational trajectories and play a key role in determining students' entry into the labor force (Dauber, Alexander and Entwisle, 1996; Kerckhoff, 2001). Once students embark on a given educational pathway, they are likely to follow a typical sequence of transitions, and their educational attainment and later career trajectories become predictable to some extent (Shavit and Müller, 1998). Hence, despite their egalitarian ethos, education systems lay the foundations for later life inequalities (Domina, Penner and Penner, 2017). This particularly applies to stratified systems that sort students into distinct, hierarchically differentiated, educational pathways, which are also referred to as tracks (c.f., Hanushek and Wößmann, 2006).

However, although education systems channel individuals into particular trajectories, individuals set and pursue their own goals while moving through the system (Schoon and Heckhausen, 2019). At multiple, sequentially organized decision points, they choose which educational goals to engage with and which to disengage from, thereby pursuing their own educational projects and (to some extent) beating their own paths (Heckhausen and Buchmann, 2019; Hitlin and Johnson, 2015). In other words, educational trajectories are not generated mechanistically by a kind of automated sorting machine. Human agency—i.e., intentional, self-motivated action—also plays a role in educational trajectories. Even highly differentiated education systems typically allow for some mobility between educational paths (Pfeffer, 2008), as they provide qualitatively distinct and alternative educational pathways that may converge at a later stage (Breen and Jonsson, 2000). All education systems are permeable to some degree, allowing students to follow standard pathways (the main channels along which a majority of students proceed) and nonstandard pathways (less well-traveled, more indirect "by-channels") through the system. Educational trajectories thus emerge from an interplay between the channeling effects of educational institutions and individual agency.

This study seeks to disentangle the relative importance of institutional structure and human agency—as manifested in study effort and persistence—for educational trajectories. Empirically, the study focuses on the Swiss education system, which is an ideal case to study in this respect because it is very hierarchically differentiated (that is, stratified) but also relatively permeable, allowing both normative and nonnormative trajectories to higher education through standard and nonstandard pathways.

EDUCATIONAL STRATIFICATION AND LIFE-COURSE CANALIZATION

This study builds upon theories of educational stratification and life-course canalization.

Educational stratification theories stress that education systems produce differences between individuals that provide the basis for later life inequalities (Hauser, 1970; Raudenbush and Eschmann, 2015). Although education systems offer learning opportunities for all, thereby enabling upward social mobility, they are also the main social institution involved in reproducing social status across generations (Kelly, 2008). This is partly because they provide unequal learning environments, distribute educational opportunities unequally, and issue different educational credentials that open up disparate sets of opportunities in the labor market. Education systems thus set individuals on their own distinct paths of relative (dis-)advantage

throughout their lives (Blossfeld *et al*., 2016; Oakes, 2005); they influence the positions individuals will occupy in social stratification systems (Domina *et al*., 2017) and shape the condition of their lives (Ainsworth and Roscigno, 2005; Blau and Duncan, 1967).

Life-course canalization theories also claim that various types of external constraints—including socio-cultural and institutional structures—mold and canalize individual development and life trajectories along certain paths (Heckhausen and Buchmann, 2019). Such constraints provide scaffolding for individuals, considerably reducing their range of potential options (Settersten Jr., 1999). At the same time, however, life-course canalization theories acknowledge that individuals strive to exert agency; they act intentionally and aim to maximize development within the bounds of specific pathways (Evans, 2007; Heckhausen, 1998, 2018). Thus, life-course canalization theories seek to explain the dynamic interplay between agent and environment, applying the idea that life courses result from an interaction between agentic individuals and structural constraints (Schoon and Heckhausen, 2019). Such theories apply to hierarchically differentiated education systems that sort students into distinct tracks and limit deviations from those tracks.

THE STRUCTURE OF THE EDUCATION SYSTEM

Hierarchically differentiated education systems are characterized by tracking. Tracking refers to the allocation of students to distinct educational programs with different academic demands. Tracking is used in education systems around the world, although its organization varies across countries (e.g., Brunello and Checchi, 2007; Burger, 2016, 2019; Van de Werfhorst and Mijs, 2010). The Swiss education system is comparatively strongly tracked; it sorts students into distinct educational trajectories that lead to quite different educational destinations. However, the system is permeable to some extent—it offers multiple, qualitatively different pathways, thereby allowing for both normative and nonnormative educational trajectories to higher education.

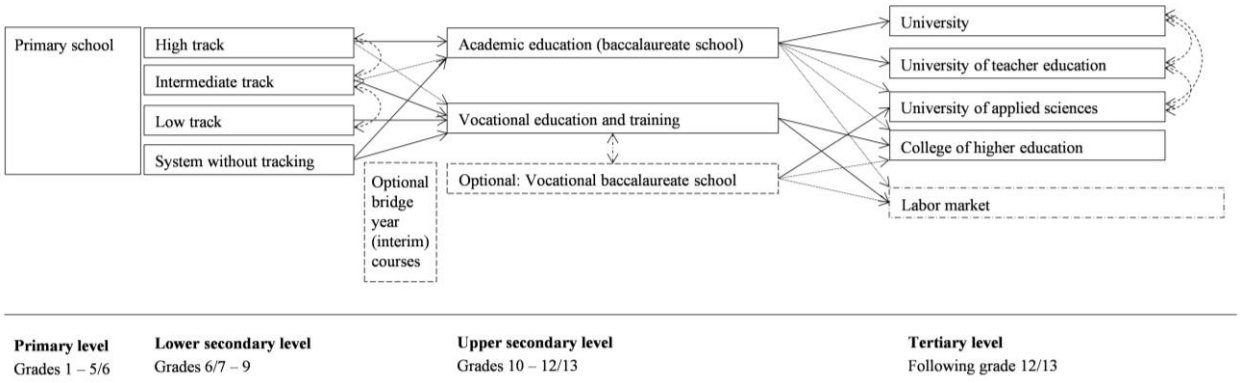

Figure 1: Simplified illustration of the Swiss education system. High, intermediate, and low track refers to educational programs with different academic requirements, ranging from the most to the least academically demanding track. Solid arrows represent typical (widespread, or, normative) educational transitions. Dotted arrows represent less typical transitions. Dashed double-headed curved arrows indicate options to transition between different tracks and types of education, which are possible when a student meets specific minimum requirements or passes additional exams. Depending on the canton, primary school encompasses either five or six school grades, lower-secondary level encompasses three or four grades (up to grade 9), and upper-secondary level encompasses three or four grades.

The structure of the Swiss education system is illustrated in Figure 1 (for more detailed information see Appendix A1). Typically, after five or six years of primary school, students are assigned to different tracks at the lower-secondary-school level. These tracks vary in their academic requirement profiles. Most school systems have three tracks: *low*, *intermediate*, or *high*. However, some schools do not use any formal tracking and instead admit students of all performance and ability levels. In these nontracked *comprehensive* schools, students are not separated into tracks but instead attend school together and follow a common curriculum.

In upper-secondary education, the two main paths are *academic education* at a baccalaureate school and *vocational education and training*. Direct admission to academic education is typically conditional on successful completion of the high track at lower-secondary-school level. However, students can also follow indirect, nonstandard pathways to academic education. For instance, they can first transition from the intermediate to the high track at lower-secondary-school level before ultimately transitioning into academic upper-secondary education. Academic upper-secondary education primarily prepares students for entry into university. By contrast, vocational education and training typically prepares students for entry into the labor market and for tertiary education at colleges of higher education.

The tertiary education system is composed of conventional universities, universities of teacher education, universities of applied sciences, and colleges of higher education (SKBF, 2014).

As noted previously, the Swiss education system is designed to be permeable. It provides pathways that bridge certain education and training programs and connect different educational levels, thereby allowing students who initially attended lower educational tracks and/or vocational programs to move up into the academic program and ultimately into higher education at the tertiary level (SKBF, 2014). To follow such alternative pathways and change educational trajectories, students need to complete supplementary programs. When they do so, they are deviating from standard educational pathways and following nonnormative trajectories. Thus, regardless of their initial educational path, students can continue on to university level by following either normative or nonnormative trajectories.

Prior research has analyzed educational trajectories in individual Swiss cantons (subnational administrative units), notably trajectories from primary to upper-secondary education (Trautwein *et al*., 2008), from lower- to upper-secondary education (Oesch, 2017), and from upper-secondary to tertiary education (Kost, 2013). These studies have shown that nonnormative educational trajectories are to some extent facilitated by the porous boundaries between different educational paths. Overall, however, studies have observed relatively low rates of upward educational mobility through nonstandard pathways, with a majority of students following normative trajectories (see also Meyer, 2018). Similar evidence has been found in other countries. For instance, studies focusing on educational trajectories during secondary education have found relatively low levels of upward educational mobility in Luxembourg (Backes and Hadjar, 2017), Germany (Berkemeyer *et al*., 2013; Biewen and Tapalaga, 2017; Jacob and Tieben, 2010), and the Netherlands (Tieben, 2011). Moreover, studies focusing on educational trajectories into tertiary education have also identified low rates of upward mobility. For instance, in the United States, nontraditional trajectories reduced students' likelihood of enrolling in college and of completing a postsecondary educational degree (Milesi, 2010). Similarly, in Germany, only a negligible proportion of individuals attained a university

degree following a nonnormative trajectory (Hillmert and Jacob, 2010). Thus, in many systems, upward educational mobility seems to be limited despite the availability of multiple educational pathways. However, human agency may determine how individuals move through the system—an issue that researchers have largely neglected so far.

HUMAN AGENCY IN EDUCATIONAL TRAJECTORIES

Human agency is usually conceptualized as a multidimensional concept, comprising aspects of goal setting and engagement, self-direction, action planning, control perceptions, and motivation (e.g., Hitlin and Johnson, 2015). Prior research has shown that specific facets of agency—such as school engagement and effort—predict educational outcomes (Carbonaro, 2005; Schoon, Burger and Cook, 2021; Schoon and Ng-Knight, 2017; Steinhoff and Buchmann, 2017). The present study focuses on two dimensions of agency that are hypothesized to be particularly relevant when considering educational trajectories: persistence and study effort.

Persistence

Persistence is a long-term process of goal-directed behavior (Sideridis and Kaplan, 2011). It represents an individual's effort to remain on task, including their commitment to pursuing an action in the face of obstacles and adversity (Linnenbrink-Garcia *et al*., 2018). Individuals who exhibit high levels of persistence are more likely to overcome multiple impediments to achieve success. Persistence entails a volitional component, reflecting a willingness to continue with a task despite difficulties. Accordingly, persistence contributes to the successful achievement of goals and may also affect school success (Raad and Schouwenburg, 1996).

Study Effort

Study effort refers to the mental resources directed toward achieving an academic goal (Finn *et al.*, 2014). It is a measure of diligence and self-discipline, revealing a student's motivation to study and the level of attention dedicated to an academic task. Because study effort indicates the willingness to engage in academic study and sustain a high level of commitment toward learning (e.g., Credé and Kuncel, 2008), it may also predict educational outcomes (see Stewart, 2008, and Appendix A2).

THE ROLE OF SOCIAL ORIGINS IN EDUCATIONAL TRAJECTORIES AND HUMAN AGENCY

Social origins may affect both educational trajectories (e.g., Becker and Hecken, 2009a; Brunello and Checchi, 2007; Dumont, Klinge and Maaz, 2019) and human agency (Schoon and Lyons-Amos, 2017). It is therefore important to take into account social origins in the current study.

Social origins can influence educational trajectories through various mechanisms, including educational decisions and aspirations (e.g., Boudon, 1974; Bygren and Rosenqvist, 2020; Gabay-Egozi, Shavit and Yaish, 2010; Jonsson and Rudolphi, 2011; Schindler and Lörz, 2012), habitus—i.e., a disposition toward education and positive orientation toward schooling (Bourdieu, 1986; Gaddis, 2013; Roksa and Robinson, 2017)—and economic, social, and cultural resources (Bourdieu and Passeron, 1970; Burger, 2019; Denice, 2019; Goldrick-Rab *et al.*, 2016; Helbling, Tomasik and Moser, 2019; Reichelt, Collischon and Eberl, 2019). Concerning the subject of this study, it is crucial to note that research has demonstrated social disparities in allocation to educational tracks at the lower-secondary school level (Pietsch and

Stubbe, 2007; Roth and Siegert, 2016; Schindler, 2015), in individuals' likelihood of following academic versus vocational paths (Bernardi and Boado, 2014; Protsch and Solga, 2016), and in the likelihood of transitioning into higher education (Becker and Hecken, 2009b; Neugebauer, 2010; Watermann, Daniel and Maaz, 2014). Socially privileged individuals are more likely to follow more academically oriented paths throughout their educational careers and ultimately attain comparatively higher levels of education (Becker and Lauterbach, 2016; Breen *et al*., 2009; Bukodi, Erikson and Goldthorpe, 2014).

In addition, some studies indicate links between social origins and human agency, suggesting that young people from socially disadvantaged families tend to develop comparatively low levels of agency in education (Gamoran and Hallinan, 1995; Schoon, 2012), often as a result of the developmental contexts they experience (Hallinan, 2001). However, recent research has found substantial variability in individuals' level of agency across social classes (Burger, Mortimer and Johnson, 2020; Burger and Walk, 2016; Hitlin and Johnson, 2015), which challenges the idea that human agency is unequally distributed across socioeconomic origins. Importantly, human agency is a key resource for successful educational trajectories, even when individuals are confronted with social constraints (Hitlin and Johnson, 2015; Samuel and Burger, 2020; Schoon and Heckhausen, 2019).

STUDY PURPOSE

Hierarchically differentiated education systems channel educational trajectories in different directions. However, within this context, there are typically partly porous boundaries between distinct educational paths, which provide a structure of opportunity for humans to exert agency. The current study seeks to disentangle the relative importance of institutional structure and human agency for educational trajectories by analyzing transition probabilities at two crucial nodes—from lower- to upper-secondary education and from upper-secondary to university education. It thus describes trajectories in terms of movements from one given educational path into a different path at a later point in time. The study also examines how human agency contributes to these transition probabilities. More specifically, it addresses three research objectives.

First, focusing on the hierarchical differentiation of the system, the study analyzes (1a) the extent to which lower-secondary-school tracking predicted individuals' probability of moving into an academic or vocational program at the upper-secondary level, while accounting for parental socioeconomic status, student achievement and further observable potential confounders. Moreover, the study examines (1b) the extent to which the differentiation of upper-secondary education into academic and vocational education predicted individuals' probability of subsequently entering a university, while controlling for parental socioeconomic status, student achievement and further potential confounders. Prior research has suggested that students are to some degree channeled through hierarchically differentiated educational paths that lead to specific normative educational trajectories, with students who start their educational career in a given track following identical routes and eventually ending up at the same educational destinations (Meyer, 2018). Accordingly, I expect lower-secondary school tracking and the differentiated upper-secondary system to strongly predict individuals' probability of moving into an academic path and into university.

Second, the study analyzes the role of human agency in educational trajectories from a structural perspective by addressing three questions: (2a) Does human agency differ across tracks and types of education? (2b) Are individuals with stronger agency more likely to transition to academic rather than vocational upper-secondary education? (2c) Are individuals with greater agency more likely to transition into university over a period of up to eleven years after completing upper-secondary education? Previous studies indicated that study effort and student motivation differ across different types of education (Carbonaro, 2005; Trautwein *et al.*, 2006) and that such factors influence educational trajectories (Covington, 2000). Thus, I expected human agency to differ across different tracks and types of education in the Swiss education system and assumed that higher levels of agency would be related to a higher probability of transitioning into academic rather than vocational education and ultimately into university.

Third, to assess the relative importance of institutional structure and human agency, the study examines (3a) whether educational transition probabilities differed between individuals who followed the same educational path but exhibited different levels of agency; and (3b) whether educational transition probabilities differed between individuals who followed different educational paths but exhibited identical levels of agency. Theory suggests that individuals conduct their lives within the limits of institutional structures, which both enable and constrain action as well as distributing opportunities differentially across different groups, thereby laying the foundations for later life-course inequalities. However, individuals steer their own trajectories, and their progression through the education system may depend on their level of agency. I therefore expected educational transition probabilities to be a function of both the educational path that individuals took and of the level of agency that they exhibited.

Finally, the study has an additional minor aim. Human agency could be the result of academic cultures, socialization processes, or assimilation effects in specific educational tracks; it may hence be a consequence rather than a determinant of educational trajectories (Eccles and Roeser, 2009; Trautwein *et al*., 2006). This study therefore analyzes whether attending a given lower-secondary track predicted students' agency during upper-secondary education.

METHOD

Sample

The study analyzed data from the Transitions from Education to Employment (TREE) panel study, a longitudinal survey examining individuals' educational and work trajectories from the last year of lower-secondary school in Switzerland.[1] The original sample included 6343 young people who participated in the Program for International Student Assessment (PISA) in the year 2000, when they were on average 15.5 years old. PISA used a two-stage stratified sampling procedure. First, schools were sampled, with probabilities proportional to the size of the student population. Second, students were sampled randomly within schools.

The current study used data spanning the whole period of observation, from 2000 up to the last currently available panel wave in 2014.[2] Between 2001 and 2007, the panel waves took place at annual intervals (t_1 to t_7). Two additional panel waves were conducted in 2010 and 2014 (t_8 and t_9). In order to analyze educational trajectories up to university education, the sample was restricted to participants with valid information on university attendance, that is, those participants who reported whether or not they had attended university during any of the

survey waves. This resulted in an analytical sample of 4986 participants (Appendix B1 provides information on how the analytical sample compares to the original sample).

Missing Data

As in most longitudinal research, the data source included missing data. To adjust parameter estimations to account for missing data, the analysis used multiple imputation, which replaces missing values with imputed data based on existing observed data (see Appendix B2).

Measures

The following measures were used (Appendix B3 provides more detailed information on the measures and their operationalizations): *sociodemographics* (sex, age, first-generation immigrant status, and parental socioeconomic status); *academic achievement* (the PISA reading score); *student self-expected socioeconomic status; study effort*; *persistence*; *lower-secondary-education track* (1. low track, 2. intermediate track, 3. high track, and 4. comprehensive school without formal tracking; dummy coded with comprehensive schools as reference category); *type of upper-secondary education* (1. academic education at baccalaureate school; 2. vocational education, typically combining work-based vocational training in firms with vocational education in specialized schools; and 3. other education, which refers to short-term interim activities; dummy coded with vocational education as reference category); and *university education* (whether a study participant ever attended a conventional university during the observation period). Table 1 provides descriptive statistics, Table 2 reports correlations for all measures.

Analytic Strategy

I generated descriptive statistics to identify the proportions of students who followed distinct educational pathways and performed analyses of variance to assess whether human agency differed across tracks and types of education, respectively. Finally, I estimated a structural equation model to evaluate the extent to which educational transition probabilities were related to the hierarchical differentiation of the education system and to human agency, respectively (Appendix B4-B5). The structural equation model included study effort and persistence as latent variables. I estimated paths between variables that exhibited a temporal sequence and modelled residual correlations to estimate associations between variables measured at the same time point. The model controlled for sex, age, immigrant status, parental socioeconomic status, academic (reading) achievement, and self-expected socioeconomic status, all assessed in grade 9.

RESULTS

Percentages of Students Who Followed Distinct Pathways

I begin by providing descriptive evidence on individuals' trajectories through the hierarchically differentiated education system (Research Questions 1a and 1b). Figure 2 summarizes the percentages of students whose educational trajectories led from a given lower-secondary track to a specific type of upper-secondary education (academic, vocational, or other) as well as the percentages of students whose educational trajectories led from a given type of upper-secondary education to university. Figure 2 also shows the percentages of students who attended a given lower-secondary track and whose educational trajectory led to university (dotted arrows). A key finding is that normative trajectories to university (i.e., trajectories that go from a high track

at lower-secondary level via academic upper-secondary education to university) occurred much more frequently than nonnormative trajectories (i.e., trajectories that lead from intermediate or low tracks via a vocational or other educational path to university). Another key finding is that the percentage of students from nontracked lower-secondary schools who pursued their educational career up to university was considerably lower than that of students who had attended a high track in a tracked system and continued to university (18.9 percent vs. 46.6 percent). Nevertheless, it was greater than the percentage of students who had attended intermediate tracks (15.7 percent) or low tracks (4.0 percent).

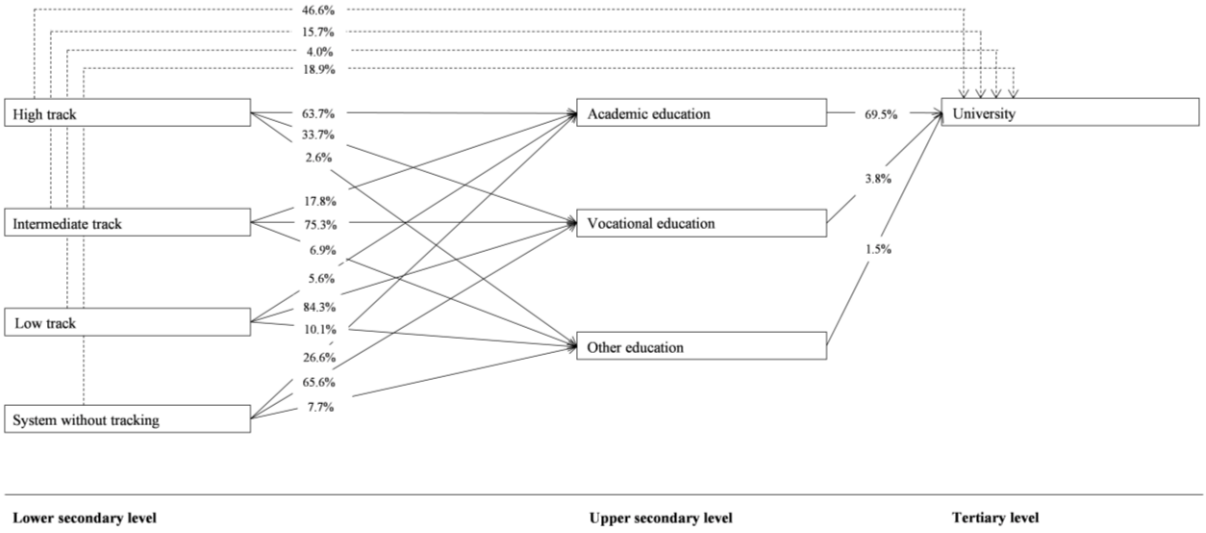

Figure 2: Percentages of students whose educational trajectory led from a given track at the lower-secondary level to a given type of upper-secondary education, and from there into university (solid arrows). Dotted arrows represent the percentages of students from a given track whose educational trajectory led up to university.

Levels of Human Agency in Tracks and Types of Education

The next issue to consider is whether human agency differs across lower-secondary tracks and types of upper-secondary education (Research Question 2a).

Concerning the lower-secondary level, the analysis of variance revealed differences in study effort across the different tracks, $F(3, 4916) = 13.27$, $p < .000$. Post-hoc analyses using the Scheffé criterion for significance showed that the average level of study effort was slightly higher in high and intermediate tracks ($M = 2.82$, $SD = .64$ and $M = 2.78$, $SD = .65$, respectively) than in low tracks ($M = 2.67$, $SD = .65$; both $p < .000$). The box plots in Figure 3 (left panel) visualize these mean differences while also revealing substantial overlaps in the distributions of study effort across tracks.

At the upper-secondary level, there was no significant difference in study effort across types of education, $F(2, 4479) = 0.036$, $p = .965$. However, persistence differed significantly across types of education, $F(2, 4609) = 17.525$, $p < .000$. The average level of persistence was higher among individuals in vocational education than among those in academic education, although the difference was very small in substantive terms ($M = 3.14$, $SD = .41$ vs. $M = 3.07$, $SD = .43$; $p < .000$). The box plots in Figure 3 visualize the similarity of the distributions of persistence (middle panel) and study effort (right panel) across the three types of upper-secondary education.

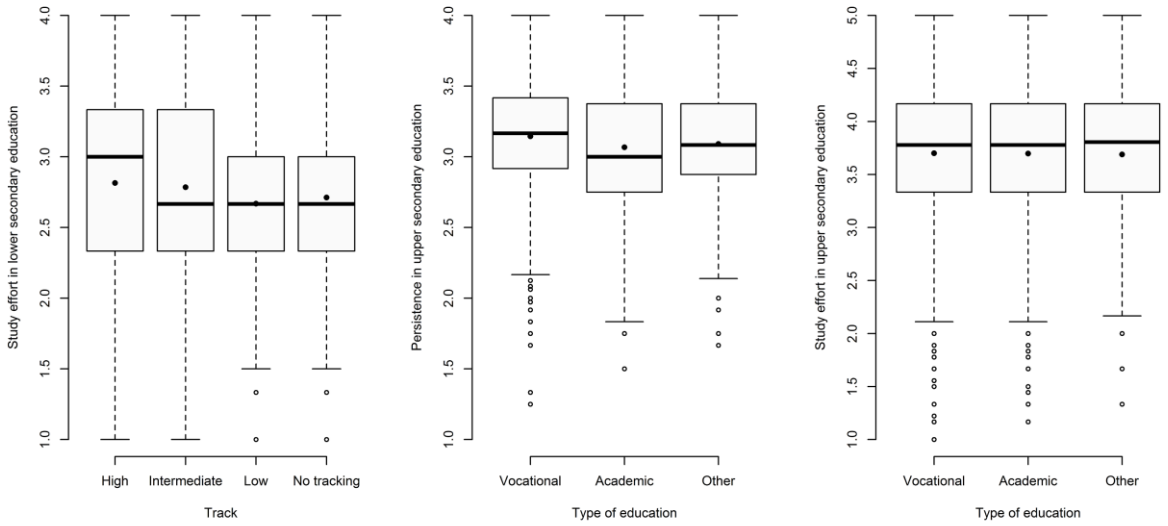

Figure 3: *Left panel*: Box plots of the distribution of self-reported study effort by lower-secondary school track attendance. *Middle panel*: Box plots of the distribution of persistence by type of upper-secondary education. *Right panel*: Box plots of the distribution of study effort by type of upper-secondary education. The horizontal line within the boxes depicts the median; the solid black circle depicts the mean; the box edges represent the 1st and the 3rd quartile. The end of the upper whisker equals (Q3 + 1.5 * IQR), the end of the lower whisker equals (Q1 – 1.5 * IQR). Observations outside the whiskers are displayed as circles.

Educational Transition Probabilities

This section provides evidence on educational transition probabilities and how these probabilities vary as a function of human agency and the system's hierarchical differentiation after accounting for potential confounding variables. Because academic achievement is arguably the primary potential confounder, it is crucial to initially evaluate the degree to which achievement levels varied between school tracks in a preanalysis. Analysis of variance indicated significant differences in academic achievement levels between lower-secondary school tracks, $F(3, 4981) = 517.81$, $p < .000$. Post-hoc analyses showed that, on average, students in high tracks outperformed those in intermediate and low tracks as well as those in comprehensive, nontracked, schools (high track: $M = 561.09$, $SD = 71.39$; intermediate track: $M = 519.07$, $SD = 73.95$; low track: $M = 452.07$, $SD = 79.01$; nontracked schools: $M = 505.09$, $SD = 77.54$; all $p < .000$). However, the achievement distributions overlapped considerably between tracks. Figure 4 displays kernel density estimates, visualizing these overlaps and indicating that a considerable proportion of relatively low achievers attended high tracks and, conversely, a significant share of relatively high achievers attended low tracks. This partly reflects the fact that children from higher-SES families are more likely to attend higher tracks even if they are comparatively low achievers (Appendix C1).

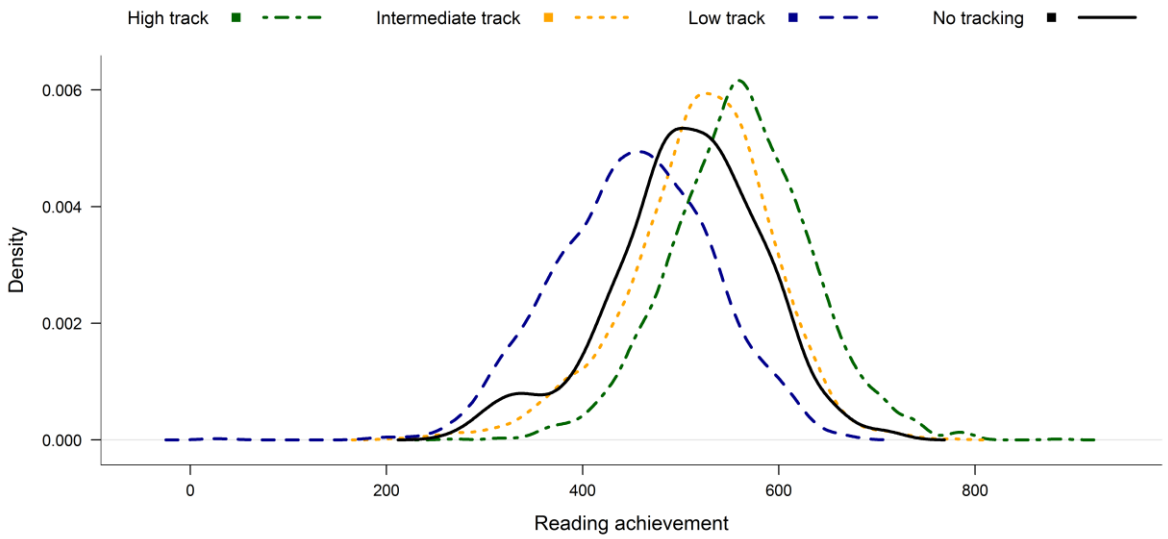

Figure 4: Distributions of reading achievement in high, intermediate, and low tracks, and in school systems that used no tracking (dash-dotted line, dotted line, dashed line, and solid line, respectively). The density curves are estimates of the probability density function. $N_{\text{high track}}$ = 1989; $N_{\text{intermediate track}}$ = 1578; $N_{\text{low track}}$ = 1118, $N_{\text{no tracking}}$ = 297. All group means are statistically different from each other at the $p < .05$ level at least (Bonferroni corrected tests).

I now consider the findings of the structural equation model. Figure 5 illustrates the central paths. Solid arrows represent statistically significant associations between the respective variables. Dashed lines indicate paths that were estimated but had nonsignificant coefficients. Table 3 reports all coefficients, including those of the control variables. I report unstandardized coefficients with cluster-robust standard errors (probit coefficients for binary endogenous variables). Table 4 summarizes the factor loadings, residual correlations, and model fit statistics.

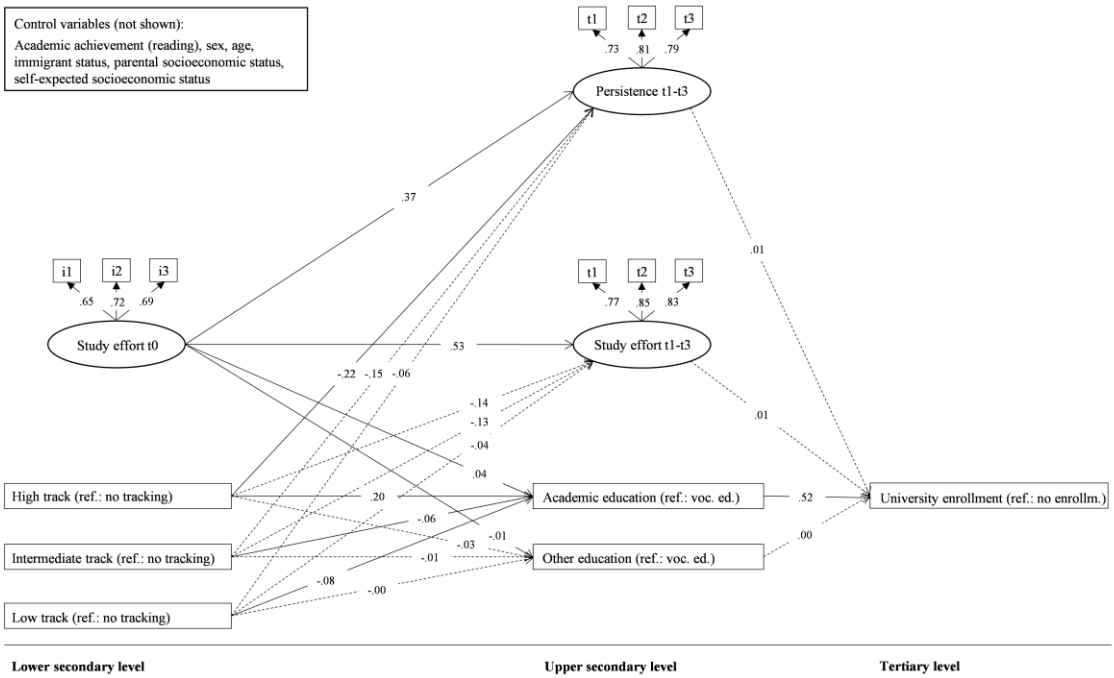

Figure 5: Structural equation model with unstandardized coefficients. Most key study variables were dummy variables; unstandardized coefficients allow for interpreting results in their original metric. i1–i3 refer to indicators 1–3; t1–t3 refer to item-parcels from panel waves 2001–2003; ref. = reference category; voc. ed. = vocational education.

I begin by investigating educational transition probabilities from the lower- to the upper-secondary level, controlling for potential confounders (Research Question 1a). Relative to students in nontracked schools, those who attended a high track in a hierarchically differentiated lower-secondary-school system were significantly more likely to enter academic rather than vocational upper-secondary education ($p < .001$). By contrast, those attending intermediate or low tracks were significantly less likely to enter academic education ($p < .05$ and $p < .01$, respectively). For the sake of interpretability, I calculated predicted probabilities. Figure 6 visualizes these probabilities and shows that, adjusted for covariates, students from a high track were, on average, 19.2 percentage points more likely to transition into an academic track at the upper-secondary level than students from nontracked schools (43.9 percent [95% CI: 39.3%, 48.4%] vs. 24.7 percent [95% CI: 17.4%, 32.0%]). Students attending intermediate or low tracks had a transition probability of 12.6 percent [95% CI: 10.1%, 15.2%] and 5.6 percent [95% CI: 3.3%, 7.9%], respectively. To interpret predicted probabilities, readers should note that the effect of a one-unit change in the predictor depends on the values of all the model parameters and other predictors. Results reported here reflect the transition probabilities for study participants with baseline characteristics on the dichotomous variables and average levels of the continuous variables.

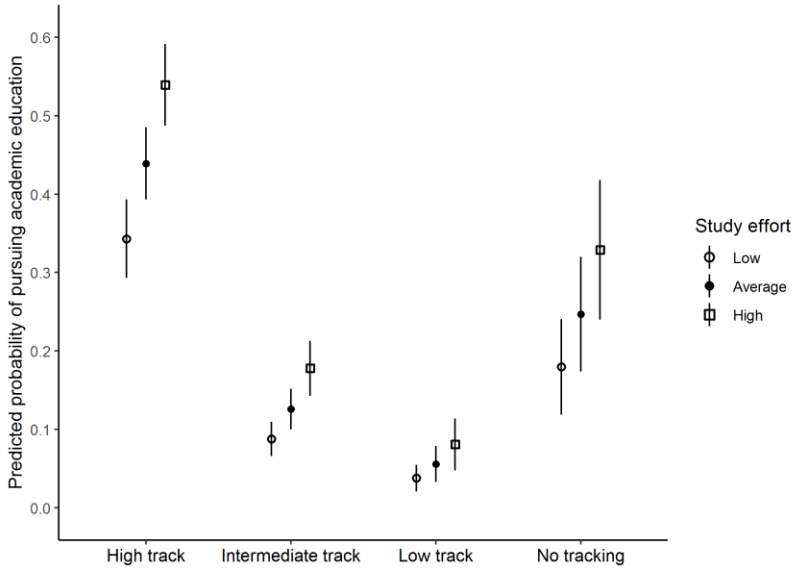

Figure 6: Predicted probabilities of pursuing academic upper-secondary education, as a function of self-reported study effort at t_0 (low = mean – 1 SD; average = mean; high = mean + 1 SD), and whether lower-secondary education was in a high, intermediate or low track, or in a school system that used no tracking. Whiskers depict 95 percent confidence intervals. $N_{\text{high track}} = 1989$; $N_{\text{intermediate track}} = 1578$; $N_{\text{low track}} = 1118$, $N_{\text{no tracking}} = 297$.

Figure 6 also shows how educational transition probabilities vary according to study effort (Research Question 2b). It indicates that, in any given track type, students who reported

high levels of study effort had a higher probability of transitioning into academic upper-secondary education (Research Question 3a). However, when I compared individuals with equivalent levels of study effort between tracks, I found that those in high tracks were considerably more likely to transition into academic education than those from intermediate or low tracks or those from nontracked schools (Research Question 3b). For instance, individuals in high tracks who reported high levels of study effort were roughly 6.6 times more likely to transition into academic education than those in low tracks who reported high levels of study effort (53.9 percent [95% CI: 48.7%, 59.1%] versus 8.1 percent [95% CI: 4.9%, 11.4%]). By contrast, individuals in high tracks who reported low levels of effort were roughly as likely to transition into academic education as individuals in nontracked schools who reported high levels of effort (34.3 percent [95% CI: 29.4%, 39.3%] versus 32.9 percent [95% CI: 24.0%, 41.8%]).

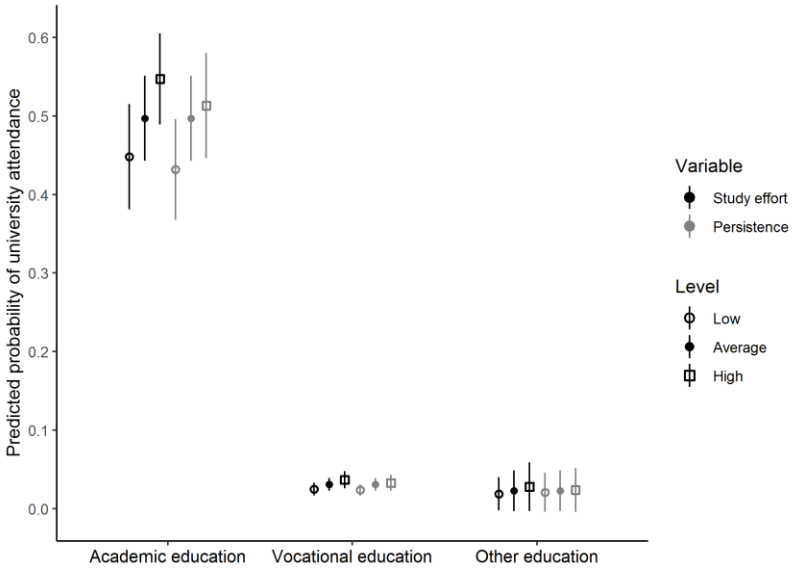

Figure 7: Predicted probabilities of attending university, with university enrollment occurring over a period of up to eleven years after completion of upper-secondary education, as a function of self-reported study effort and persistence at t_1-t_3 (low = mean – 1 SD; average = mean; high = mean + 1 SD), and whether upper-secondary education was academic, vocational, or some other type of education. Whiskers depict 95 percent confidence intervals. $N_{\text{academic education}} = 1591$; $N_{\text{vocational education}} = 2776$; $N_{\text{other education}} = 273$.

The analysis then considered educational transition probabilities from the upper-secondary level to university, controlling for potential confounders (Research Question 1b). Relative to students who completed vocational education, those who pursued academic upper-secondary education were significantly more likely to transition into a university at any time between 2004 and 2014, when they were on average between 19.5 and 29.5 years old ($p < .000$). Figure 7 expresses these results as conditional predicted probabilities and shows that, on average, students who pursued academic education at upper-secondary level were, ceteris paribus, 16 times more likely to attend a university than students who had initially pursued vocational education (49.7 percent [95% CI: 44.3%, 55.1%] versus 3.1 percent [95% CI: 2.2%, 3.9%]). There was no significant difference in probabilities between the vocational-education

group and the group that had pursued "other" educational activities (2.3 percent [95% CI: -0.3%, 4.9%]). These results are consistent with findings from studies of Germany, where only around 3 percent of individuals who followed a nonnormative educational trajectory attained a university degree (Hillmert and Jacob, 2010). Figure 7 also illustrates how the predicted probabilities varied by study effort and persistence at t_1-t_3 (Research Question 2c). For individuals who had attended academic upper-secondary education, both study effort and persistence were positively, albeit not significantly, related to the likelihood of university attendance (Research Question 3a). Among individuals who had initially pursued vocational or other education, the likelihood of later attending a university was exceedingly low, regardless of study effort and persistence. Thus, the transition probabilities into university differed significantly for those who followed different upper-secondary educational paths, even when they exhibited identical levels of study effort and persistence (Research Question 3b).

I now turn to the additional minor aim of the study, that is, the question of whether attending a given lower-secondary-school track predicted students' agency during upper-secondary education. The results show virtually no significant relationships between lower-secondary track attendance and subsequent levels of persistence and study effort (at t1-t3). The only significant relationship identified here was between high track attendance and subsequent levels of persistence ($p < .05$). Moreover, Table 4 shows that the residual correlations between the human agency indicators and the type of upper-secondary education pursued were very small, ranging from -.001 to -.087. The residual correlations between study effort and lower-secondary track attendance were negligible, ranging from -.018 to .038. These findings add to literature on the consequences of specific learning environments for student role identities (Eccles and Roeser, 2009). They indicate that human agency was very weakly related to different learning contexts in the Swiss education system. One potential explanation is that individuals can develop high levels of agency under a variety of circumstances as long as they perceive optimal challenges (Abuhamdeh and Csikszentmihalyi, 2009).

In addition, it is worth noting that the levels of study effort remained relatively stable from lower- to upper-secondary level, as indicated by the positive path coefficient ($b = .531$, $p < .001$). Furthermore, study effort in lower-secondary education was positively related to persistence during upper-secondary education ($b = .372$, $p < .001$). Note also that several control variables were associated with the key study variables (detailed information in Table 3 and Appendix C2).

DISCUSSION

This study sought to analyze the extent to which a stratified education system and human agency (persistence and study effort) influenced educational trajectories. Findings suggested that the pathways individual students took through the system significantly predicted students' probability of entering an academic or a vocational program as well as the probability of eventually attending a university. Students who followed standard academic pathways were substantially more likely to subsequently transition into university than those who followed nonstandard pathways, even when controlling for academic achievement and human agency. For instance, only a small percentage (< 4 percent) of individuals initially participated in a vocational upper-secondary education program before entering an academic path to university. This is in line with evidence from the United States and Germany, where individuals who

followed a nontraditional route through postsecondary education had a significantly reduced likelihood of enrolling at a university (Hillmert and Jacob, 2010; Milesi, 2010). This finding supports theories of educational stratification and life-course canalization, which suggest that institutionalized opportunity structures have channeling effects, leading individuals to follow paths carved out by the system (Heckhausen, 2018).

Yet, while the findings suggest that the education system shaped educational trajectories, they further indicate that human agency also mattered, albeit more so at early stages in individuals' educational careers. Individuals' study effort in lower-secondary education was significantly related to their probability of transitioning into academic upper-secondary education, a finding that resonates with evidence suggesting that different levels of study effort lead to different educational outcomes (Carbonaro, 2005). In contrast, neither study effort nor persistence during upper-secondary education were significantly related to the likelihood of transitioning into university. Thus, the opportunity to bring individual agency to bear varied across different junctures in the system. In Switzerland, the system had stronger channeling effects at the juncture from upper-secondary to tertiary education than at the juncture from lower- to upper-secondary education. This finding is particularly noteworthy considering that the Swiss education system is designed to be permeable; it should, in principle, allow for mobility between different tracks and types of education and offer students the opportunity to enter university via a nonstandard educational pathway. The finding that human agency was not significantly associated with the probability of transitioning into a university resonates with research showing that human-agentic factors only influence attainment when institutional structures allow them to (e.g., Shanahan, Elder and Miech, 1997). Clearly, the power of human agency to predict educational transitions is restricted in systems that strongly canalize individual educational trajectories (Evans, 2007; Steinhoff and Buchmann, 2017). In Switzerland, the hierarchical institutional differentiation seemed to structure students' trajectories through the system, largely precluding university enrollment by students who followed nonstandard pathways and hence limiting their upward mobility. Among these students, even high levels of human agency were not related to an increased likelihood of transitioning into university. This finding is at odds with evidence from the United States and England which indicate that student motivation positively affects a wide range of educational outcomes (Schoon *et al*., 2021; Schoon and Ng-Knight, 2017; Stewart, 2008). It might, however, be explained by the nature of the compulsory education systems in both the United States and England—these are formally less stratified than the Swiss education system (Chmielewski, Dumont and Trautwein, 2013), which might make agentic resources more important than in Switzerland. Alternative potential explanations for why human agency was related significantly to individuals' probability of transitioning into academic upper-secondary education but insignificantly related to the probability of transitioning into university include the fact that virtually all students transition into upper-secondary education, whereas only around a fifth of all students—i.e., a more select group—transition into university (Meyer, 2018). Added to this, there is the fact that transitioning to university is associated with opportunity costs because university is not a necessary requirement to enter the labor market; likewise, the role of universities of applied sciences may be important here, as these also open the door to successful professional careers in Switzerland, potentially diminishing the need to be highly agentic specifically to enter university.

Limitations and Recommendations for Future Research

This study has some limitations (Appendix D1). First, future research should assess both academic achievement and human agency prior to school entry and at regular intervals during schooling to enable researchers to disentangle the consequences of these dimensions across all junctures in the education system. Second, the measures are limited in that they only reflect some facets of human agency. It would be valuable to use additional variables in future research to capture values, beliefs, goals, and personality as drivers of agency (e.g., Almlund *et al*., 2011) as well as some observational rather than self-reported measures of agency. Third, educational transition probabilities differ to some extent between and within cantonal education systems. Future research should collect region-specific data and analyze regional disparities in these probabilities. Fourth, although this study used a prospective design and a clearly pre-specified two-stage stratified sampling method and controlled for observable potential confounders in order to make the comparison groups exchangeable, a randomized controlled trial would be necessary to estimate causal effects more accurately. This study is based on longitudinal observational data and provides robust empirical evidence of the associations between institutional differentiation and human agency on the one hand and educational transition probabilities on the other; however, it cannot demonstrate causality. Finally, this study analyzed transition probabilities into upper-secondary education and into university depending on the educational route that individuals took and their human agency. It did not examine different types of student mobility flows or distinguish rates of horizontal, downward, and upward mobility. Future research should shed light on the complexity of individual educational trajectories. Such research could use data on monthly education episodes and analytic techniques such as event history or sequence analysis.

CONCLUSION

The hierarchically structured education system seemed to channel many students through standard academic pathways to university, casting a long shadow on the academic careers of those who pursued nonacademic paths and who were therefore more likely to end up at less academic destinations despite similar levels of academic achievement and human agency. Compared to human agency, lower-secondary school tracking was a more powerful predictor of individuals' probability to transition to academic upper-secondary education. Moreover, individuals rarely took nonstandard pathways to university, largely independently of their level of agency. These findings contribute to a growing body of literature suggesting that individuals live their lives within the bounds of institutional and social structures, which may open up and constrain opportunities differentially across specific groups, engendering wider and more long-lasting inequalities in society. Such structures mold and canalize individual trajectories, restricting the influence that human agency can have on these trajectories. Indeed, this study suggests that any benefits of human agency for educational attainments are undermined by institutional structures that strongly channel trajectories along certain pathways, as is often the case in highly stratified systems. From a policy perspective, the study highlights the need to reconsider the meaningfulness of the hierarchically differentiated structure of education systems as well as the importance of implementing strategies to effectively facilitate nonnormative trajectories to university for well-performing and academically motivated students.

ENDNOTES

1. The Swiss panel study TREE (Transitions from Education to Employment) is a social science data infrastructure mainly funded by the Swiss National Science Foundation and located at the University of Bern (Distribution: data service, FORS, Lausanne).
2. Hence, the study examined individuals from age 15 to 30, the life phase in which the vast majority of university-bound students first transitioned into university (BFS, 2015).

Table 1. Descriptive statistics for the study variables

Measures	Assessed in year	Mean	SD	Min.	Max.	*N*
Male	2000	0.44		0	1	4986
Age (in years) [(a)]	2000	15.50	0.64	11.83	19.00	4974
Immigrant status	2000	0.13		0	1	4962
Parental SES	2000	51.00	16.25	16.00	90.00	4614
Self-expected SES	2000	54.94	17.65	16.00	90.00	3839
Academic achievement (reading)	2000	519.97	85.12	27.60	884.49	4982
Study effort t_0	2000	2.77	0.65	1	4	4922
Lower secondary education	2000					4984
High track		0.40		0	1	
Intermediate track		0.32		0	1	
Low track		0.22		0	1	
No tracking		0.06		0	1	
Upper secondary education	2002					4640
Vocational education		0.60		0	1	
Academic education		0.34		0	1	
Other education		0.06		0	1	
Tertiary education						4986
University	2004-2014	0.26		0	1	
Persistence t_1	2001	3.11	0.51	1	4	4604
Persistence t_2	2002	3.13	0.50	1	4	4512
Persistence t_3	2003	3.11	0.48	1	4	3915
Study effort t_1	2001	3.74	0.74	1	5	4104
Study effort t_2	2002	3.70	0.77	1	5	3966
Study effort t_3	2003	3.67	0.79	1	5	3435

Note: Descriptive statistics based on nonimputed data. *N* = number of cases. Immigrant status = first-generation immigrant (born abroad). SES = socioeconomic status. Other education = other educational activities as described in the Measures section. University refers to conventional universities, rather than universities of applied sciences and universities of teacher education. "Study effort t_0" refers to the average score of the three-item scale assessing study effort in 2000. "Persistence (t_1-t_3)" and "study effort (t_1-t_3)" refer to the average score of the four-item scale assessing the respective construct in panel waves 2001, 2002, and 2003, respectively. The descriptive statistics for persistence and study effort are for manifest mean scores of the variables; those for all individual items used to calculate the average scale scores are provided in Appendix Table B3.2. [(a)] All participants were assessed in grade 9, with 82.5 percent being between 14 and 16 years old. However, participants' age ranged from 11.83 to 19.00 years. In a sensitivity analysis, the sample was restricted to those participants who were between 14 and 16 years old at t_0 (n = 4111). This analysis yielded a highly similar pattern of results, confirming all major conclusions of the study.

Table 2. Correlations among the study variables

	1	2	3	4	5	6	7	8a	8b	8c	8d	9a	9b	9c	10	11	12	13	14	15
1	1.00																			
2	.056***	1.00																		
3	.004	.121***	1.00																	
4	.007	-.135***	-.142***	1.00																
5	.019	-.152***	-.007	.271***	1.00															
6	-.129***	-.122***	-.247***	.293***	.326***	1.00														
7	-.030*	.048*	-.026	.029*	.123***	.124***	1.00													
8a	-.043**	-.036*	-.079***	.271***	.383***	.394***	.061***	1.00												
8b	.002	.020	-.040**	-.036*	-.135***	-.007	.019	-.555***	1.00											
8c	.046**	.043**	.135***	-.248***	-.289***	-.429***	-.081***	-.438***	-.366***	1.00										
8d	.003	-.042**	.005	-.057***	-.017	-.044**	-.021	-.205***	-.172***	-.135***	1.00									
9a	.110***	.155***	.004	-.286***	-.451***	-.333***	-.128***	-.440***	.218***	.261***	.029*	1.00								
9b	-.079***	-.209***	-.054***	.342***	.522***	.419***	.158***	.512***	-.240***	-.316***	-.039**	-.882***	1.00							
9c	-.070***	.099***	.099***	-.095***	-.114***	-.151***	-.054***	-.115***	.029*	.094***	.019	-.305***	-.181***	1.00						
10	-.016	-.174***	-.065***	.307***	.434***	.373***	.135***	.392***	-.154***	-.266***	-.039**	-.621***	.711***	-.141***	1.00					
11	.034*	.012	.051***	-.068***	-.018	-.084***	.249***	-.074***	.031*	.045**	.014	.073***	-.065***	-.021	-.032*	1.00				
12	.037*	-.029	.008	-.076***	-.006	-.054***	.228***	-.053***	-.003	.043**	.044**	.071***	-.066***	-.015	-.020	.542***	1.00			
13	.029	-.022	.021	-.049**	-.021	-.052**	.214***	-.061***	.000	.061***	.022	.054**	-.060***	.009	-.016	.493***	.583***	1.00		
14	-.052**	.023	.031	-.074***	-.033	-.073***	.364***	-.066***	.029	.047**	.001	.028	-.011	-.041*	.015	.398***	.316***	.290***	1.00	
15	-.086***	-.005	.003	-.059***	-.006	-.067***	.334***	-.051**	-.004	.059***	.015	-.007	.006	.006	.027	.307***	.385***	.303***	.577***	1.00
16	-.124***	.006	.018	-.045*	-.018	-.078***	.298***	-.050**	-.009	.063***	.019	-.021	.008	.036*	-.003	.286***	.309***	.375***	.512***	.627***

Note: 1 = Male; 2 = Age (in years); 3 = Immigrant status; 4 = Parental SES; 5 = Self-expected SES; 6 = Academic achievement (reading); 7 = Study effort t_0; 8a = Lower-secondary level: High track; 8b = Lower-secondary level: Intermediate track; 8c = Lower-secondary level: Low track; 8d = Lower-secondary level: No tracking; 9a = Upper-secondary level: Vocational education; 9b = Upper-secondary level: Academic education; 9c = Upper-secondary level: Other education; 10 = Tertiary education: University; 11 = Persistence t_1; 12 = Persistence t_2; 13 = Persistence t_3; 14 = Study effort t_1; 15 = Study effort t_2; 16 = Study effort t_3. The table reports Pearson coefficients for correlations between continuous variables, point-biserial coefficients when the correlation includes a dichotomous variable, and Phi coefficients when both variables are dichotomous.
* $p < .05$, ** $p < .01$, *** $p < .001$.

Table 3. Path coefficients of the structural equation model

Outcome	Predictor	*B*	*SE*
Lower-secondary level			
Educational track [(a)]			
High track	Parental SES	.004***	.000
	Immigrant status	.009	.022
	Male	-.015	.015
	Age	.044***	.011
	Self-expected SES	.008***	.000
	Academic achievement (reading)	.002***	.000
Intermediate track	Parental SES	-.000	.001
	Immigrant status	-.050*	.024
	Male	.008	.016
	Age	.003	.012
	Self-expected SES	-.004***	.000
	Academic achievement (reading)	.000*	.000
Low track	Parental SES	-.003***	.000
	Immigrant status	.044*	.019
	Male	.006	.013
	Age	-.028**	.013
	Self-expected SES	-.004***	.000
	Academic achievement (reading)	-.002***	.000
Study effort t_0	Parental SES	-.001	.001
	Immigrant status	-.048	.062
	Male	-.061	.041
	Age	.149***	.032
	Self-expected SES	.007***	.001
	Academic achievement (reading)	.001***	.000
Upper-secondary level			
Academic education	Parental SES	.004***	.000
	Immigrant status	.063**	.020
	Male	-.040**	.013
	Age	-.086***	.010
	Self-expected SES	.008***	.000
	Academic achievement (reading)	.001***	.000
	Study effort t_0	.044***	.008
	Lower-secondary level track [(a)]		
	High track	.204***	.029
	Intermediate track	-.059*	.030
	Low track	-.081**	.029
Other education	Parental SES	-.000	.000
	Immigrant status	.036**	.013
	Male	-.039***	.008
	Age	.027***	.007
	Self-expected SES	-.001*	.000
	Academic achievement (reading)	-.000***	.000
	Study effort t_0	-.010*	.005
	Lower-secondary level track [(a)]		
	High track	-.027	.018
	Intermediate track	-.005	.018
	Low track	-.001	.019
Persistence t_{1-3}	Parental SES	-.004**	.001
	Immigrant status	.059	.062
	Male	.100*	.041
	Age	-.093**	.032
	Self-expected SES	-.001	.001
	Academic achievement (reading)	-.001**	.000
	Study effort t_0	.372***	.025

	Lower-secondary level track [(a)]		
	High track	-.219*	.090
	Intermediate track	-.153	.089
	Low track	-.062	.093
Study effort t_{1-3}	Parental SES	-.004**	.001
	Immigrant status	-.011	.063
	Male	-.251***	.041
	Age	.044	.032
	Self-expected SES	-.001	.001
	Academic achievement (reading)	-.001***	.000
	Study effort t_0	.531***	.027
	Lower-secondary level track [(a)]		
	High track	-.140	.090
	Intermediate track	-.134	.089
	Low track	-.035	.093
Tertiary level			
University	Parental SES	.002***	.000
	Immigrant status	.006	.017
	Male	.038**	.011
	Age	-.019*	.009
	Self-expected SES	.003***	.000
	Academic achievement (reading)	.001***	.000
	Persistence	.007	.007
	Study effort	.010	.006
	Upper-secondary level education [(b)]		
	Other education	.003	.024
	Academic education	.515***	.014

Note: Unstandardized coefficients (*B*) with cluster-robust standard errors (*SE*). For binary endogenous variables, probit coefficients are reported. [(a)] Reference category = No tracking (comprehensive school). [(b)] Reference category = Vocational education.
* $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed tests).

Table 4. Factor loadings, residual correlations, and model fit statistics

Latent factor	Indicators	Loading
Persistence t_1-t_3	Persistence t_1	.729***
	Persistence t_2	.813***
	Persistence t_3	.792***
Study effort t_1-t_3	Study effort t_1	.767***
	Study effort t_2	.854***
	Study effort t_3	.826***
Study effort t_0	Indicator 1 t_0	.649***
	Indicator 2 t_0	.720***
	Indicator 3 t_0	.687***
Residual correlation between	**and**	**Coefficient**
Lower-secondary level		
Study effort t_0	High track	-.018
	Intermediate track	.038
	Low track	-.017
High track	Intermediate track	-.596***
	Low track	-.278***
Intermediate track	Low track	-.449***
Upper-secondary level		
Persistence t_1-t_3	Other education	-.012
	Academic education	-.087***
	Study effort t_1-t_3	.427***
Study effort t_1-t_3	Other education	-.010
	Academic education	-.001
Other education	Academic education	-.094***
Model fit statistics		
χ^2 (*df*)	572.04 (100)	
CFI	.983	
TLI	.967	
RMSEA [90% CI]	.031 [.028, .033]	

Note: N = 4986. Reported factor loadings are standardized estimates in a model identified by constraining all factor variances to be 1.0. These estimates are based on standardized observed and latent model variables and unstandardized covariates. The indicators (persistence t_1-t_3 and study effort t_1-t_3) are average scores of the four-item scales used to assess the respective constructs in a given panel wave. Other education and academic education are binary variables, and consequently point-biserial residual correlations are reported where these variables are included. CI = confidence interval.
* $p < .05$, ** $p < .01$, *** $p < .001$ (two-tailed tests).

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ONLINE APPENDIX – SUPPLEMENTARY MATERIALS

Human Agency in Educational Trajectories: Evidence from a Stratified System

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Abstract

This file contains supplementary information for "Human Agency in Educational Trajectories: Evidence from a Stratified System." It is designed to be used as a reference for readers seeking information on specific subjects. It is not designed to be read from beginning to end.

Contents

Part A. Theoretical background

A1. The Swiss Education System

Structure of the System

The Swiss education system is decentralized, with the cantons (subnational administrative units) retaining jurisdiction over much educational policy. Consequently, the structure of the education system varies to some extent between and even within cantons.

Primary schools are comprehensive nontracked schools that provide either five or six years of schooling. In these schools, all children are schooled together based on a common curriculum.

At the lower-secondary level, most students are assigned to different tracks in separate schools or, less frequently, separate classes within schools. These tracks vary by their academic requirement profile (low, intermediate, or high). The most common track allocation criterion is students' school performance, as indicated by school grades and student assessments, in combination with teacher assessments of students' performance and behavior. In addition, students' and parents' perspectives may be considered in determining track assignment (SKBF 2014).

Compulsory schooling ends after completion of lower-secondary education (grade 9). However, postcompulsory education has become necessary to obtain the minimum qualifications required to enter the job market. Thus, students typically transition from lower- to upper-secondary education when they are between 15 and 16 years old.

The two main paths at the upper-secondary level are *academic education* at baccalaureate schools and *vocational education and training*. Approximately a third of each birth cohort pursues academic education, whereas about two thirds of students pursue vocational education and training (Buchmann et al. 2016). Students transition into academic education *or* vocational education and training depending on whether they completed lower-secondary education in a high, intermediate or low track, their school grades, and their individual choices. Direct admission to academic education at a baccalaureate school is typically conditional on successfully completing the high (academic) track at the lower-secondary-school level (Neuenschwander and Garrett 2008). However, in a few cantons, students from intermediate (but not low) tracks can transition directly into academic upper-secondary education if they have a sufficiently high grade-point average (SKBF 2014). Students can also pursue nonnormative trajectories through indirect, nonstandard, pathways to academic education. For example, they can first transition from the intermediate to the high track at the lower-secondary-school level before ultimately transitioning into academic upper-secondary education. Academic upper-secondary education at a baccalaureate school primarily prepares students for entry into a university (ISCED 6-level program; this includes both conventional universities and the two federal institutes of technology, ETH and EPFL). To directly enter a university or a university of teacher education, students must graduate from a baccalaureate school (SKBF 2014). By contrast, vocational education and training typically involves a combination of work-based vocational training in companies (on-the-job training) and vocational education in specialized schools. This "dual system" is intended to prepare vocational students for

labor market entry and for tertiary education at colleges of higher education. Provided that students in the dual system also complete a noncompulsory vocational baccalaureate school, they can be admitted to universities of applied sciences.

The tertiary education system encompasses (a) universities, providing academic education up to the doctorate level; (b) universities of teacher education and universities of applied sciences, providing vocationally-oriented education up to a master's degree level; and (c) colleges of higher education, providing an advanced level of professional education and training.

Permeability in the System

In the Swiss education system, students are to some degree channeled along the hierarchically stratified tracks and types of upper-secondary education (academic versus vocational). Various normative educational trajectories exist, meaning that relatively large proportions of students follow identical routes and eventually end up at the same educational destinations (BFS 2003, 2017; Meyer 2018). For instance, as indicated in Figure 1, most students who attend "high tracks" at the lower-secondary level will transition directly into academic education at the upper-secondary level, and many of these students will eventually transition into universities or universities of teacher education (typical transitions, represented by solid arrows). By contrast, a comparatively small proportion of these students will transition into vocational education and training (untypical transition, represented by a dotted arrow). However, the system is also designed to be permeable. It provides educational pathways that bridge certain education programs and connect different educational levels, thereby allowing students who initially attend lower educational tracks and/or vocational education and training to move up into academic routes and ultimately into higher education at the tertiary level (Graf 2013; SDC 2017; SKBF 2014). Students can follow these alternative pathways and change their educational trajectories by completing supplementary programs; in doing so, they deviate from standard educational pathways and follow nonnormative trajectories instead. For instance, a vocational education and training diploma combined with an optional vocational baccalaureate allows students to enter universities of applied sciences. Moreover, within the tertiary education system—which includes universities, universities of teacher education, and universities of applied sciences—students may switch from one type of institution to another if they obtain at least a bachelor's degree from any of these institutions (CRUS, KFH, and COHEP 2010).

A2. Persistence and Study Effort—Distinct Concepts

In light of theory and research that distinguishes domain-specific from general motivational constructs and processes, persistence and study effort should be regarded as separate factors. The general construct of persistence is often too broad to predict specific behaviors accurately. For instance, persistence does not necessarily translate into high levels of study effort (Zimmerman and Risemberg 1997). Both persistence and study effort pertain to motivational dimensions. However, they are distinct in that persistence captures a domain-general process of sustained commitment and continued investment in action in the face of obstacles, whereas study effort is a

domain-specific construct that refers solely to the amount of energy expended in the process of studying. Empirical research confirms that persistence and effort are empirically distinct factors (Elliot, McGregor, and Gable 1999), a finding replicated in the present study (see section B4).

Part B. Method

B1. Sample

The original sample and the analytical sample were similar in terms of sociodemographic characteristics. In comparison to the original sample, the analytical sample included a slightly smaller percentage of men (43.76 percent vs. 45.77 percent) and first-generation immigrants (12.86 percent vs. 14.30 percent), individuals with virtually identical parental socioeconomic status (M = 51.00, SD = 16.25; vs. M = 50.38, SD = 16.28, on the standard international socio-economic index scale, which ranges from 16 to 90), and individuals who exhibited somewhat better academic achievement, as measured by the PISA reading score (M = 519.97, SD = 85.12; vs. M = 510.01, SD = 89.00). In 2000, at the time of the PISA assessment, the participants were on average 15.50 years old (SD = 0.63).

Note that that the PISA scores differ significantly between first-generation immigrants and native-born individuals, both in the analytic sample (M = 465.57, SD = 92.60; vs. M = 528.36, SD = 80.68) and in the original sample (M = 455.44, SD = 95.40; vs. M = 519.87, SD = 83.84).

B2. Missing Data

The percentage of missing data (item nonresponse) on the study variables varied between 0 and 31.1 percent across panel waves in the analytic sample, but it was no more than 7.6 percent on average across items and waves. Table 1 in the article provides an overview of the valid (non-missing) data for all study variables (complete N = 4986). Missing data potentially pose a threat to the generalizability of the results. To adjust parameter estimation to the missing data, I used multiple imputation, replacing missing values with imputed data based on existing observed data. Multiple imputation allows for more accurate parameter estimations while maintaining the variability in the sample and associations among research variables (Sinharay, Stern, and Russell 2001). Following Acock's (2005) and Graham's (2009) recommendation of including the whole set of study variables in the imputation to minimize bias in the estimation, I included all variables used for the analysis in the imputation procedure. I generated 50 imputations employing the Multivariate Imputation by Chained Equations (MICE) package version 2.46.0 in the *R* statistical computing environment (van Buuren and Groothuis-Oudshoorn 2011), each based on five iterations. I thereby produced 50 plausible values for each missing value and accounted for the uncertainty associated with missing data (Lang and Little 2018). The MICE algorithm imputes continuous, binary and categorical data, using predictive mean matching and (polytomous) logistic

regression imputation methods, respectively. Rubin's (1987) rule was used to pool point estimates and standard errors across the imputed data sets.

B3. Measures

In the TREE panel survey, questionnaires were mailed to study participants to collect data. Most data collection took place from April to June in each wave. Those participants who did not return the questionnaire were contacted and invited to participate in a telephone interview. Table B3.1 provides a detailed overview of the measures used here.

Table B3.1 Overview of the Measures

Variable	Description
Sex	0 = Female 1 = Male
Age	Measured in years
Immigrant status	0 = Born in Switzerland 1 = Born abroad (first-generation immigrant)
Parental socioeconomic status (SES)	Assessed on the standard international socio-economic index of occupational status (ISEI) scale (Ganzeboom, De Graaf, and Treiman 1992), using the score of the higher-status parent.
Academic achievement	The PISA reading score was used as an indicator of academic achievement in grade 9. In PISA 2000, reading was assessed comprehensively among all students, using multiple reading tasks to represent three major reading literacy aspects: retrieving information from reading material, interpreting what is read, and reflecting upon and evaluating what is read (Adams and Wu 2002).
Student self-expected socioeconomic status	In grade 9, participants reported their self-expected socioeconomic status, assessed on the socio-economic index of occupational status (ISEI) scale.
Study effort	Study effort was assessed both as part of the PISA assessment in 2000 and as part of the TREE panel survey in subsequent years. *Study effort at the lower-secondary school level* To capture study effort at the lower-secondary school level, I used three items from the PISA assessment, beginning with the statement "When studying, …" and followed by "I keep working even if the material is difficult," "I try to do my best to acquire the knowledge and skills taught," "I put forth my best effort." These items were evaluated on a four-point rating scale ranging from 1 (never) to 4 (always) (Cronbach's alpha t_0: .72).

	Study effort during upper-secondary education To capture study effort during upper-secondary education, I used three items from the TREE panel survey: "I make a great effort at school," "When I am studying, I do it as diligently as possible," and "When I am studying, I give my best" (Moser 1997). These items were evaluated on a five-point rating scale ranging from 1 (not at all true) to 5 (entirely true). Here, I used data from three panel waves to represent study effort from 2001 to 2003. During this period, all study participants were in upper-secondary education (with the first transitions into university occurring in 2004). Cronbach's alpha varied somewhat across the three waves (t_1: .74, t_2: .79, t_3: .80). All between-wave correlations were positive, and their strength was moderate to strong. Moreover, the constructs from the PISA assessment and the TREE survey were positively correlated (Table 2).
Persistence	*Persistence during upper-secondary education* Persistence was assessed only as part of the TREE panel survey. No equivalent measure existed in the PISA assessment. The persistence measure consisted of four items: "If I decide to accomplish something, I manage to see it through," "I complete whatever I start," "Even if I encounter difficulties, I persistently continue," and "I keep at a painstaking task until I have carried it through" (Grob and Merki 2001). The items were evaluated on a four-point rating scale ranging from 1 (not at all true) to 4 (entirely true). To capture individuals' persistence during upper-secondary education, I used data from three panel waves—2001 to 2003. Cronbach's alpha varied marginally across the three panel waves (t_1: .74, t_2: .76, t_3: .77). All between-wave correlations were positive, and their strength was moderate to strong (Table 2).
Lower-secondary-education track	The school tracks in lower-secondary education differed by the academic requirements, ranging from basic to advanced requirements. I labeled these *low*, *intermediate*, and *high track*. Moreover, some students attended *comprehensive* schools that did not use any formal tracking. An individual student could attend only one of these tracks or a nontracked school at a time; multiple answers could not be given. The four different track types were recoded into three dummy variables, with the reference category being the nontracked schools. This allowed for comparing educational transition probabilities between individuals from a given track in tracked schools with those from nontracked comprehensive schools. Comprehensive nontracked schools are found alongside formally tracked schools in 10 out of 26 cantons, notably in Bern, Geneva, Luzern, Nidwalden, Obwalden, Schaffhausen, Schwyz, Uri, Zug, and Zurich. Jura and Ticino rely entirely on comprehensive schools (SKBF 2007). The analyses performed in this study rely on the assumption that these cantons constitute a random sample of all cantons and that there is no systematic confounding of track types and cantons. It is,

	however, important to recognize that the majority of students in Switzerland are assigned to a tracked lower-secondary school, with only a minority attending comprehensive schools. The current sample reflects these proportions as only roughly six percent of study participants attended a comprehensive school.
Type of upper-secondary education	Three types of upper-secondary education were distinguished: 1) academic education, which is provided at baccalaureate schools; 2) vocational education, which typically combines work-based vocational training in firms with vocational education in specialized schools; and 3) other education. This third category (other education) referred to individuals engaged in short-term activities such as internships, language stays, language courses, or preparation courses for vocational or general education as well as those individuals who were not in education, employment, or training or who were employed and did not pursue any educational program. I dummy coded the indicator of upper-secondary education using the vocational education group as the reference category, because this was the largest group of the sample (59.8 percent). Data from the 2002 wave were used, because, by that time 94.1 percent of the study participants were attending either a vocational or an academic education program, that is, one of the two main types of upper-secondary education. In contrast, in 2001, only 83.3 percent of the sample were attending a vocational or academic education program, while 16.7 percent were pursuing other educational activities (see 'Operationalization of the indicator of upper-secondary education' below).
University education	A dichotomous variable was used to assess whether a study participant had ever attended a conventional university (see Fig. 1) during the observation period. The first transitions into conventional universities occurred in 2004 (n = 259); hence this variable assessed whether a participant had attended a conventional university during any of the six last survey waves, between 2004 and 2014. Ideally, I would like to have analyzed educational careers up to university graduation instead of only up to university attendance. However, due to a large proportion of missings on the variable measuring graduation, I did not include that latter variable in the analysis. According to official statistics, in Switzerland, the university dropout rate among students who enrolled at a conventional university around the turn of the millennium was 13.5 percent (BFS 2012). This suggests that a majority of students who reported attending a conventional university in the TREE survey were likely to ultimately attain a university degree.

Descriptive Statistics for Individual Items Used to Measure Persistence and Study Effort

Table 1 (in the article) reports descriptive statistics for persistence and study effort. These statistics are for manifest mean scores of the variables; those for all individual items used to calculate the average scale scores are provided in Table B3.2 hereafter.

Table B3.2 Descriptive statistics for the items used to measure persistence and study effort in the panel waves 2000-2003

Measures	Assessed in year	Mean	SD	Min.	Max.	*N*
Study effort t_0	2000					
Item 1		2.68	.80	1	4	4866
Item 2		2.80	.78	1	4	4874
Item 3		2.82	.84	1	4	4922
Persistence t_1	2001					
Item 1		3.20	.66	1	4	4331
Item 2		3.23	.66	1	4	4576
Item 3		3.07	.67	1	4	4562
Item 4		2.94	.72	1	4	4546
Persistence t_2	2002					
Item 1		3.24	.60	1	4	4478
Item 2		3.23	.65	1	4	2283
Item 3		3.10	.63	1	4	4480
Item 4		2.97	.69	1	4	4453
Persistence t_3	2003					
Item 1		3.20	.59	1	4	3899
Item 2		3.21	.63	1	4	3894
Item 3		3.09	.61	1	4	3885
Item 4		2.94	.67	1	4	3879
Study effort t_1	2001					
Item 1		3.53	.95	1	5	4095
Item 2		3.69	.93	1	5	4090
Item 3		3.99	.86	1	5	4087
Study effort t_2	2002					
Item 1		3.48	.96	1	5	3953
Item 2		3.65	.94	1	5	3958
Item 3		3.96	.86	1	5	3944
Study effort t_3	2003					
Item 1		3.46	.98	1	5	3422
Item 2		3.63	.95	1	5	3424
Item 3		3.92	.88	1	5	3411

Note. The Measures section describes the individual items; t_0 to t_3 denote the respective panel waves.

Operationalization of the Indicator of Upper-Secondary Education

Around the turn of the millennium, nearly a quarter of all students began upper-secondary education after a preparatory program and/or other interim solutions, which lasted up to a year (Coradi Vellacott and Wolter 2004). Thus, relative to the 2001 data, which represented more interim solutions, the 2002 data reflected participants' upper-secondary education type more accurately, although results from analyses based on 2001 data were very similar. Ninety-five percent of the participants who were attending vocational education in 2002 were also attending vocational education in 2003 (Phi coefficient = 0.853), and 96.0 percent of the participants who attended academic education in 2002 were also attending academic education in 2003 (Phi coefficient = 0.965). Since many vocational-education programs only last two or three years in Switzerland, combining data from several panel waves would not be appropriate here. The individual-level fluctuation between academic, vocational, and other educational programs across waves was lowest between 2002 and 2003. Thus, the 2002 data were most indicative of participants' upper-secondary education. Note also that in Switzerland the vast majority of individuals transition from lower- to upper-secondary education. Compulsory schooling ends after completion of lower-secondary education. However, in practice, post-compulsory education or training has become necessary to obtain the minimum qualifications required to enter the labor market. In the current sample, for instance, the percentage of study participants who were not in education or training in the panel waves that cover the period during which most individuals pursued some type of upper-secondary education were very low, amounting to 2.3 percent in wave 1 (2001), 2.8% in wave 2 (2002), and 4.2% in wave 3 (2003).

B4. Structural Equation Model

The structural equation modeling approach has several notable strengths, including estimation of residual correlations and multiple endogenous variables. Moreover, it minimizes the biasing effects of measurement error through the use of latent variables (constructs) measured by multiple items (Kline 2016).

Latent variable analyses were conducted in two stages. In the first stage, I performed confirmatory factor analyses to evaluate the measurement model and assess the correlation between the latent constructs—persistence and study effort. To estimate individual study effort in lower-secondary education in 2000 (at t_0), I formed a latent construct based on three individual indicators. By contrast, to estimate study effort and persistence during upper-secondary education (2001–2003, or t_1 to t_3), I formed two latent constructs based on three parcels of items per construct. Each parcel was formed by the average score on the four-item scale assessing the respective construct in a given panel wave—that is, in 2001, 2002, and 2003, respectively.[1] Given the three-year observation span, this parceling approach is preferable to using twelve individual items as

[1] The first indicator of each latent construct was the average scale score in the first panel wave (2001), the second indicator was the average scale score in the second wave (2002), the third indicator was the average score in the third wave (2003).

indicators; it also reduces the amount of error in complex model estimations (Coffman and MacCallum 2005; Little et al. 2013). Substantively, my aim in creating two latent factors covering persistence and study effort over a three-year period was to assess individuals' habitual levels of persistence and study effort, thus capturing individuals' tendency to display a given behavior over time and across situations rather than their persistence and study effort in a given panel wave. The confirmatory factor analyses revealed that persistence and study effort were distinctive constructs and therefore should not be collapsed into a single factor that combines all the facets of the two constructs. A simple CFA model measuring only the two constructs as separate factors exhibited a model fit ($\chi^2 = 217.8$, $df = 8$, RMSEA = .100, CFI = .963, SRMR = .030) that was superior to a one-factor model ($\chi^2 = 1384.95$, $df = 9$, RMSEA = .242, CFI = .760, SRMR = .101). In the two-factor solution, the residual correlation between the two latent factors was $r = .43$ ($p < .001$), indicating a moderate positive relationship.

In a second stage, I estimated a structural equation model that included persistence and study effort as latent constructs. This model was estimated in *R* version 3.5.0, using the lavaan package version 0.6-1 (Rosseel et al. 2018). The model accounted for the clustering of students in educational tracks and upper-secondary educational programs, estimating cluster-robust standard errors. I employed the WLSMV estimator, which uses diagonally weighted least squares to estimate model parameters and a mean- and variance-adjusted chi-squared test statistic to compute cluster-robust standard errors.

Overall model fit was evaluated using three goodness-of-fit indices—comparative fit index (CFI), Tucker-Lewis index (TLI), and root mean square error of approximation (RMSEA)—because different fit indices are differentially sensitive to different types of model misspecification (Hu and Bentler 1998). I also report the global chi-square (χ^2) and degrees of freedom for the composite (measurement and path) model. However, because the χ^2 statistic is sensitive to small differences in the covariance structures of large samples (Marsh, Balla, and McDonald 1988), the χ^2 value is not typically interpreted as the main criterion of goodness of fit. Fit is considered acceptable when CFI > .90, TLI > .90, and RMSEA < .08 (Kline 2016; McDonald and Ho 2002).[2] Given the fit indices shown in Table 4, the model reported here represents a very good fit to the data.

B5. Research Ethics

All data analyses were performed on anonymous and secondary data. All procedures performed in the original study, which involved human participants, were in accordance with the ethical standards of the institutions involved in data collection.

[2] Note the controversy around the use of fixed cut-off points to assess the fit of models (e.g., Chen et al. 2008), particularly in nonlinear probability models (Xia and Yang 2019).

Part C. Results

C1. Sensitivity Analyses

The overlap in the achievement distributions across all four track types ranged from 268.79 points (minimum achievement in "high track") to 661.77 points (maximum achievement in "low track"). This range included 96.4 percent of all cases of the analytical sample. In sensitivity analyses, I truncated the sample to estimate the structural equation model, excluding those 3.6 percent of cases for which there was no achievement overlap across tracks. In so doing, I generated a subsample with comparable cases in terms of academic achievement across all track types, thus to a limited extent mimicking a randomized trial with observational data. Here, however, I present results that are based on the nontruncated sample, because the objective of this study is not only to predict individuals' probability of transitioning into a specific type of upper secondary education, depending on lower-secondary track attendance, but also to predict the probability of attending a university later in the educational career. For that purpose, it is appropriate to retain the full analytical sample. Note, however, that the results of the analysis using the truncated sample fully confirm the results reported here.

C2. Associations Between Control Variables and Study Variables

This section summarizes significant associations ($p < .05$ at least) between the controls and the study variables. At the lower-secondary level, the likelihood of attending a high track rather than a comprehensive school was higher among those with higher parental SES, comparatively older students, those with higher self-expected SES, and those with higher academic achievement levels (all variables measured in grade 9). The likelihood of attending an intermediate track was higher for native-born students, those with a higher self-expected SES, and those with lower academic achievement levels. Finally, the likelihood of attending a low track was higher for those with lower parental SES, first-generation immigrants, comparatively younger students, those with a lower self-expected SES, and for below-average achievers. Furthermore, we note that study effort at t0 was significantly higher among comparatively older students, those who had a higher self-expected SES, and those who exhibited higher academic achievement.

At the upper-secondary level, the probability of attending academic rather than vocational upper-secondary education was higher for individuals with higher parental SES, immigrants, females, comparatively younger study participants, those with a higher self-expected SES, and those who exhibited better academic achievement and higher levels of study effort in lower-secondary education. The probability of attending other rather than vocational education was higher for immigrants, females, comparatively older individuals, and those with lower self-expected SES, academic achievement and study effort.

Further results suggest that persistence and study effort during upper-secondary education (t1-3) were weaker among individuals with higher parental SES. This latter finding contradicts theory suggesting that socially privileged students exhibit higher levels of motivation, effort, and

persistence (Gamoran and Hallinan 1995). Although the differences found here might reflect differences in response styles or subjective perceptions of persistence and effort, it is possible that high-SES students were, on average, effectively less persistent and exerted less effort. This possibility would be in line with evidence showing that students' probability of entering a specific educational track and following a specific educational trajectory is related to family background characteristics (Brunello and Checchi 2007). Students from high-SES families are often more likely to enter academic paths and eventually attain higher levels of education than their counterparts from low-SES families, even if they exhibit otherwise similar characteristics (Dumont et al. 2019). Such social gradients in educational outcomes have been found repeatedly (Burger 2016, 2019; Lucas 2001) and might explain why high-SES students in the current study were somewhat more likely to attend academic education despite reporting lower levels of persistence and study effort.

Moreover, results indicate lower levels of persistence and study effort (t1-3) among above-average achievers, which might indicate that high-achieving individuals had to exert less effort to be academically successful or that they subjectively perceived these actual study efforts differently. Self-reported persistence (t1-3) was stronger among males and younger individuals, whereas self-reported study effort (t1-3) was lower among males than females.

Finally, the likelihood of attending a university was higher for those with higher parental SES, males, comparatively younger individuals, those with a higher self-expected SES, and those with better academic achievement. However, the type of upper-secondary education (academic vs. vocational) was the single most influential predictor of university attendance, as indicated by standardized path coefficients (estimated in a complete-case model without imputed data; not reported for conciseness).

Part D. Discussion

D1. Limitations and Recommendations for Future Research

Despite notable strengths of the data source and the analytical strategy—including the long observation period, simultaneous estimation of multiple endogenous variables, and examination of both normative and nonnormative educational trajectories as well as of the relative weight of structure and agency in those trajectories—this study has limitations. The following section discusses these limitations as well as recommendations for future research in more detail.

(1) The study conceptualizes persistence and study effort as genuinely psychological constructs. However, the availability of economic resources may also play a role in longer-term effort and persistence (Bozick 2007). Hence, although the current study controlled for parental socioeconomic status, future research should disentangle the various psychological, socioeconomic, and cultural factors underlying motivational orientations. Moreover, it would be essential to assess motivation from an even more multidimensional perspective, using a variety of variables. That research could integrate cognitive and non-cognitive factors that might predict

educational trajectories (Almlund et al. 2011; Burger 2019; Burger et al. 2020; Duckworth et al. 2019; Schoon et al. 2021). Research suggests, for instance, that noncognitive abilities such as perseverance, self-control, self-esteem, risk aversion, and time preferences shape educational outcomes even when controlling for cognitive skills (Borghans et al. 2008; Burger and Walk 2016; Heckman 2008). Individuals possess a range of capabilities including pure cognitive skills such as IQ and noncognitive abilities which, in turn, may foster cognitive skills but also impact on life-course outcomes directly (Kautz et al. 2014; Smithers et al. 2018). Future research could address a gap in the literature by examining the interplay between cognitive and noncognitive factors and the institutional structure of education systems as predictors of individual educational trajectories.

(2) The standardized measure of academic achievement used here reflects individuals' performance levels at the end of lower-secondary education, prior to the transition to upper-secondary education. Ideally, future research should assess academic achievement repeatedly during the schooling period. This would allow researchers to identify the extent to which academic achievement predicts transition probabilities at different junctures as well as the extent to which following distinct educational paths influences standardized achievement scores. Moreover, it would make it possible to assess achievement growth in these different paths as well as reciprocal relationships between students' academic motivation (or agency) and achievement over the course of formal schooling. Similarly, human agency should be measured over the whole schooling period so that researchers will be able to identify outcomes of human agency and institutional structure across all junctures in the education system. Repeated measurements of student achievement and human agency would also allow for using individual fixed effects models, which would assess the effects of within-person variation in a repeatedly measured variable on variation in a repeatedly measured outcome. In this study, individual fixed effects models cannot be used because the central predictors and outcomes were measured only once. Specifically, track attendance measured in the year 2000 is used to predict track attendance in the year 2002; and track attendance in 2002 is used to predict whether individuals have ever enrolled at a university (yes/no). For that purpose, structural equation models are appropriate. Although the structural equation model cannot reduce the impact of confounding of time-invariant variables, it benefits from notable strengths that other techniques do not have. This includes simultaneous estimation of multiple outcome variables, estimation of residual correlations, and the possibility to minimize biasing effects of measurement error through the use of latent constructs measured by multiple items. It also minimizes the risk of reverse causation by relying on variables with a clear temporal ordering.

(3) The latent constructs assessing persistence and study effort during upper-secondary education drew on data covering a three-year observation period from 2001 to 2003. These constructs were supposed to capture whether persistence and study effort during upper-secondary education would predict individuals' subsequent transitions into university (the first transitions into university occurred in 2004). Individual levels of persistence and study effort might have changed to some extent after 2003. However, additional analyses revealed high correlations between constructs based on a 7-year observation period (covering 2001 to 2007) and constructs measured in a single wave between 2001 and 2003; they ranged from $r = .770$ to $r = .799$ for

persistence and from $r = .798$ to $r = .835$ for study effort. Thus, on average, persistence and study effort were relatively stable over time.

(4) In Switzerland most students attend lower-secondary education in a tracked system (SKBF 2007). This is reflected in the present sample, where only 5.96 percent of participants were from nontracked comprehensive schools. The relatively small proportion of students in comprehensive schools might compromise the generalizability of the results that pertain to students from comprehensive schools. However, the sample still included 297 study participants from comprehensive schools; hence the present results are far from being uninformative. These results should be interpreted cautiously. Yet the fact that the study detected significant differences in the transition probabilities between students in comprehensive schools and those in tracked systems suggests that these differences were substantial, especially given the restricted power of the statistical analysis.

(5) This study does not analyze flows of students who access universities of applied sciences and universities of teacher education with nontraditional entrance qualifications. Universities of applied sciences and universities of teacher education may grant access to students through validation of prior learning and work experience, with or without entrance examination (whereas conventional universities do not accept nontraditional entrance qualifications). Future research should analyze whether individuals who display higher levels of agency and who follow nonstandard educational pathways are more likely to enter universities of applied sciences and universities of teacher education with nontraditional entrance qualifications.

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