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NEPS TECHNICAL REPORT FOR WEIGHTING: WEIGHTING THE SAMPLE OF STARTING COHORT 3 OF THE NATIONAL EDUCATIONAL PANEL STUDY (WAVES 1 TO 3)

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NEPS Technical Report for Weighting: Weighting the Sample of Starting Cohort 3 of the National Educational Panel Study (Waves 1 to 3)

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NEPS Technical Report for Weighting: Weighting the Sample of Starting Cohort 3 of the National Educational Panel Study (Waves 1 to 3)

Abstract

The sample of Grade 5 students in the National Educational Panel Study (NEPS) respects different timings in transitions in lower secondary education. Some Federal States in Germany educate students in primary schools from Grade 1 to Grade 6, whereas the majority of primary schools educate students from Grade 1 to Grade 4. The transition to lower secondary education is also decoupled from primary and lower secondary education in some Federal States. These Federal States provide education to students in schools only covering Grade 5 and 6. Thus Grade 5 students sampled in NEPS will leave their institutional context in which they were originally sampled and surveyed in some Federal States. For this reason a refreshment sample of students in Grade 7 was established to compensate the loss of students in their institutional context. This report provides details on the sampling design, the derivation of design weights and the nonresponse adjustments for the refreshment sample. On the school level we find school type and Federal State of the school to be predictive of the schools decision to participate. On the student level we find grades in German and maths to significantly influence the students decision to participate in the panel. For the group of students participating in the panel study we find explaining factors such as native language, being in a special-needs school and being surveyed outside the institutional context of a school.

Keywords

stratified multi-stage sampling, unit nonresponse, weighting, NEPS SC3

1. Introduction

Starting Cohort 3 (SC3) of the National Educational Panel Study (NEPS) focuses on students in Grade 5 and their pathway through lower secondary education.[1] To follow up Grade 5 students a main sample of students in regular schools and special-need schools was set up.[2] Besides the main sample, a supplement covering students with a migration background related to Turkey and the former Soviet Union was established. These samples are referred to as *original samples*. Because of the Federal-State-specific timing in transition in lower secondary education in regular schools a refreshment sample was drawn for students attending Grade 7. The information arising from surveying and testing students is enriched by a computer assisted telephone interview (CATI) with one parent. Adapting this multi-informant perspective NEPS collects additional information on the students family and social background.

To provide weights for the original samples as well as for the refreshment sample the different processes leading to the participation decision in a certain wave have to be considered. These decision processes include the schools initial decision to participate in the survey, the students initial decision to participate in the survey, and finally, the students successive decisions to participate in each wave again. The schools initial decision to participate enters a nonresponse adjusted design weight on the institutional level. The students initial decision to participate enters a nonresponse adjusted design weight on the individual level. The successive decisions of a student to participate in a certain wave enter the corresponding wave-specific cross-sectional and longitudinal weights. Although the decision of a parent to participate in the CATI is decoupled from the students participation decision, the two decisions are likely to be correlated. For the group of participating students for whom an interview with their parents was conducted we provide additional (cross-sectional and longitudinal) weights.

In the progress of the panel it is possible that students cannot be surveyed within their institutional context for several reasons. For example, because they switch to another school, or because the school decides to refuse further cooperation. In these cases students are surveyed in an individual context, that is, the questionnaires are sent to their home address. Surveying students in this individual context is referred to as the field of individual retracking. Because these students are surveyed outside of their institutional context the participation propensity is lower for this group. Also we find native language, design information (strata) as well as participation in the previous wave to be significant explaining factors of student nonresponse. The participation decisions of a parent are influenced by almost the same characteristics as the students decision. Here, the age group of their child additionally influences their participation decision.

For weighting and the nonresponse adjustments of weights several particularities have to be considered. Therefore, this paper will provide details on the sampling designs applied within the different samples, the initial nonresponse adjustments on the school and on the student level as well as wave-specific nonresponse adjustments. The remainder of this report referring to Scientific Use Files (SUFs) Versions 3.0.0 and 3.1.0 (DOI:10.5157/NEPS:SC3:3.0.0 and DOI:10.5157/NEPS:SC3:3.1.0) is structured as follows: Section 2. gives information on the population and the sampling designs applied to realize the samples of SC3. Section 3. provides information on the initial sample and nonresponse processes leading to the final panel cohort of SC3. Section 4. documents the wave-specific nonresponse adjustments to provide

[1] For more specific information on research topics in the NEPS, see Blossfeld, Roßbach, and von Maurice (2011).

[2] Regular schools are all ``allgemeinbildende Schulen´´, that is, schools of general education according to the definition of the Kultusministerkonferenz (2012).

cross-sectional and longitudinal weights. Section 5. documents the raking procedure applied to the nonresponse adjusted cross-sectional weights. Section 6. provides details on the trimming method applied to the entire set of target-specific weights and their final scaling. Finally, Section 7. concludes.

2. Population and Sample

The target population of SC3 covers Grade 5 students in schools offering lower secondary education within the Federal Republic of Germany in school year 2010/11. Excluded are students attending schools with a predominant foreign teaching language and students who are not able to follow the normal testing procedure attending regular schools, see Aßmann et al. (2011). Access to this population was gained via the schools these students are educated in. SC3 consists of two samples in Wave 1 and Wave 2; the *main sample* and the *migrant supplement*. From Wave 3 on the *refreshment sample* is part of the SC3, too. The corresponding variable in the weighting data set is `sample`, see Table 1. School types, as provided in the sampling frame, which were relevant for sampling schools in SC3 are given in Table 2.

2.1 Main Sample and Migrant Supplement

Both samples are two-stage samples selecting schools as primary sampling units (PSU) on the first stage. In the main sample students are selected in classes (main sample) and according to their migration background (migrant supplement). The main sample is in parts overlapping with the sample of Starting Cohort 4 (SC4) and stratified by

- *Schools educating students in Grade 5 and in Grade 9* (overlap with SC4),
- *Schools educating students in Grade 5 but not in Grade 9*, and
- *Special-needs schools* (overlap with SC4),

see Variable `stratum_exp` in Table 1. For implicit stratification[3] of the main sample the characteristics, see Table 1, used are

- *school type* (`stratum_imp1`),
- *Federal State* (`stratum_imp2`),
- *regional classification* (`stratum_imp3`), and
- *funding institution* (`stratum_imp4`).

The variable `tstud_st` gives information on the study the student was first surveyed in. Here, the two strata covering the population of regular schools refer to study A28, special-needs schools refer to study A56 and the migrant supplement refers to study A63, see Table 1.[4] For more details on the sampling design and the derivation of design weights, see Steinhauer, Aßmann, Zinn, Goßmann, and Rässler (2015).

[3] Sorting the sampling frame by certain characteristics together with a systematic selection is referred to as implicit stratification.

[4] Reports from the studies can be accessed via the documentation section at (DOI:10.5157/NEPS:SC3:1.0.0). For successive waves the students of study A63 have been integrated into the follow ups of A28, that is, A29 and A30.

2.2 Refreshment

The refreshment sample is, with respect to the sampling design, similar to the main sample of regular schools. We applied a stratified two-stage sampling design with explicit and implicit stratification. The two explicit strata respect the different timings in transitions in lower secondary education. The first stratum $h = 1$ therefore consists of all regular schools located in the Federal States of Berlin and Brandenburg that do not have classes in Grade 5 and 6 but have at least one class in Grade 7. The second stratum $h = 2$ contains all regular schools located in the remaining 14 Federal States of Germany having at least one class in Grade 7. The students of the refreshment sample are surveyed within the study A30A first. The $m = 100$ schools to be sampled were allocated to the strata as follows: In stratum $h = 1$ we sampled $m_1 = 20$ schools and in stratum $h = 2$ we sampled $m_2 = 80$ schools. Schools already sampled for SC3 or SC4 were excluded. Further we considered school type, Federal State, regional classification, and founding institution as characteristics for implicit stratification. Within the two strata schools were selected systematically on the first stage using probability proportional to size (pps) sampling. The total number of schools in the population is $M = \sum_{h=1}^{2} M_h$. For systematic pps sampling we define the measure of size for school j in stratum h as

$$mos_{jh} = \frac{C_{jh}^7}{\min\{C_{jh}^7; 2\}}, \tag{1}$$

where C_{jh}^7 denotes the number of classes in Grade 7 that school j in stratum h hosts according to the frame referring to school year 2008/09. The inclusion probability π_{jh} for school j in stratum h is computed as

$$\pi_{jh} = m_h \cdot \frac{\frac{C_{jh}^7}{\min\{C_{jh}^7;2\}}}{\sum_{j=1}^{M_h} \frac{C_{jh}^7}{\min\{C_{jh}^7;2\}}} \tag{2}$$

On the second stage we randomly select two classes within sampled schools if at least three are present. Otherwise all available classes are selected. All students of the selected classes are then asked to participate. Finally, the inclusion probability π_{ijh} for student i in school j in stratum h is computed as

$$\pi_{ijh} = m_h \cdot \frac{\frac{C_{jh}^7}{\min\{C_{jh}^7;2\}}}{\sum_{j=1}^{M_h} \frac{C_{jh}^7}{\min\{C_{jh}^7;2\}}} \cdot \frac{\min\{\widetilde{C}_{jh}^7; 2\}}{\widetilde{C}_{jh}^7}, \tag{3}$$

where $\widetilde{C}_{jh}^7$ denotes the number of classes school j in stratum h hosts in school year 2012/13. Note that, when the number of classes a school j hosts in school year 2012/13 is the same as in the frame, then a self-weighting sample is realized. The design weight d_{jh} for a school j in stratum h and the design weight d_{ijh} for a student i are computed as

$$d_{jh} = \pi_{jh}^{-1} \quad \text{and} \tag{4}$$

$$d_{ijh} = \pi_{ijh}^{-1}. \tag{5}$$

3. Initial Nonresponse Adjustments

Sampling schools on the first stage and students in classes on the second stage forms a two-stage decision process. Within two-stage sampling designs nonresponse occurs at two different levels. On the first stage, schools decide weather to participate or not. On the second stage, students can decide again to participate or not, but only given a positive participation decision of the school. To account for the different nonresponse processes we use successive response propensity modelling. Steinhauer et al. (2015) give more details on the replacement strategy to prevent bias caused by schools refusal together with nonresponse adjustments for initial nonresponse for the main sample and the migrant supplement.
In the refreshment sample 86 out of 374 contacted schools decided to participate, resulting in a response rate of 23.0%. Of the 288 nonparticipating schools only 178 explicitly refused, the remaining 110 schools just did not respond. On the school level we used cell weighting to adjust weights. The cells were formed by school type and Federal State, because these characteristics influence the participation propensities, see Table 3. Within each cell the sum of the design weights for schools was reallocated to the participating schools. Thus, the nonresponse adjusted weight for school j in stratum h arises as

$$w_{jh} \quad = \quad d_{jh} \cdot \frac{\sum_{j=1}^{m_h} d_{jh}}{\sum_{j=1}^{m_h^R} d_{jh}}. \tag{6}$$

Here $\sum_{j=1}^{m_h} d_{jh}$ is the sum of design weights for all sampled schools j in stratum h and $\sum_{j=1}^{m_h^R} d_{jh}$ is the sum of design weights of the participating schools. This weight is included in the weighting data as `w_i`, see Table 1.
Table 4 gives the number of students initially sampled, the number of students participating in the panel study (panel sample), and the corresponding participation rates for the different samples of SC3. The table shows that the response rate on the student level for the refreshment sample is similar to the main sample. Analogue to the findings from the main sample (see Steinhauer et al., 2015) the participation propensity of a student is significantly positive influenced by having good grades in German and significantly negative by having missing values in the math grade, see Table 5. The estimated participation propensity δ_{ijh} for student i in institution j in stratum h from the model displayed in Table 5 is used to compute the weight according to

$$w_{ijh} \quad = \quad \underbrace{d_{jh} \cdot \frac{\sum_{j=1}^{m_h} d_{jh}}{\sum_{j=1}^{m_h^R} d_{jh}}}_{w_{jh}} \cdot \frac{\min\{\widetilde{C}_{jh}^7; 2\}}{\widetilde{C}_{jh}^7} \cdot \frac{1}{\delta_{ijh}}. \tag{7}$$

This weight is included in the weighting data as `w_t`, see Table 1.

4. Wave-specific Nonresponse Adjustments

Students being part of the SC3 panel can decide in each wave wether they want to participate again or not. We distinguish three different participation statuses, namely: participant, temporary drop out, and final drop out. A student is considered as final drop out if the panel consent is withdrawn and the student refuses further participation in the panel. In contrast, a student

is considered as temporary drop out if the student does not participate in the current wave but is generally willing to participate in future waves and has not withdrawn panel consent. Participants are all students that provide any information. Table 6 gives the number of students and their participation status by wave. To account for the wave-specific participation decision of students we use response propensity re-weighting to provide corresponding weights. To model binary participation decisions we use a random intercept model that accounts for clustering at the school level with probit link function. The coefficients for the estimated random intercept probit models are displayed in Table 7 and described below.
Surveying and testing students is accompanied by a telephone interview with one parent. Via this telephone interview parents provide valuable background information on their children, for example on social or family background. Therefore parents were asked if they are willing to participate in the panel study together with their children. Because the decisions of students and parents are likely to be correlated, we apply bivariate binary probit models allowing for the estimation of a correlation parameter. The coefficients for the estimated bivariate binary probit models are displayed in Table 8 and described below.
We provide cross-sectional weights for those students participating in a certain wave and longitudinal weights for students participating in all successive waves. The provided cross-sectional weights for students (`w_t1`, `w_t2`, and `w_t3`) as well as for students and parents (`w_tp1`, `w_tp2`, and `w_tp3`) refer to the participants of the main sample and the refreshment sample. Longitudinal weights for students (`w_t12` and `w_t123`) as well as for students and parents (`w_tp12` and `w_tp123`) correspond to the participants of the main and the refreshment sample participating in all successive waves of the panel.
At Wave t there are $2^t - 1 = 7$ different binary participation patterns for students. Also considering the joint participation statuses of students and parents additionally increases the number of groups to provide weights for. To cope with the increasing number of weights, consecutive conditional modeling for participation decisions is helpful. Here, we model participation decisions conditional on auxiliary variables as well as on earlier participation statuses, see for example Kalton (1986) and Lepkowski (1989). Given the nonresponse adjusted design weight w_{ijh} for a participant i in institution j in stratum h, the wave-specific nonresponse adjusted weight is

$$\omega_{ijh}(t) = \quad w_{ijh} \cdot \lambda_{ijh}(t)^{-1}, \tag{8}$$

where $\lambda_{ijh}(t)$ is the participation propensity for participant i in institution j in stratum h at Wave t. Specifying $\lambda_{ijh}(t)$ depends on the subgroup which is considered for re-weighting, for example, students participating in Wave 2 or students continuously participating in all successive waves up to Wave 2. The two examples given relate to different types of weights, namely cross-sectional weights and longitudinal weights. For an explicit formulation of the re-weighting procedure and more details on the wave-specific nonresponse adjustments referring to the previous SUF versions DOI:10.5157/NEPS:SC3:1.0.0 and DOI:10.5157/NEPS:SC3:2.0.0 see Steinhauer, Zinn, and Aßmann (2016, forthcoming).
When modelling the participation decision of students, we exclude 242 students being part of the migrants supplement, because their field procedures as well as survey and test instruments differ significantly from those of the main sample. Moreover, we exclude cases finally dropping out of the panel cohort. This is because, first, their decision to not participate in future waves of the survey is different from the decision to temporarily refuse participation and, second, their quantity is too small to allow for an accordant multinomial model. Thus, analyses focus

on the main sample and on the refreshment sample. These two groups are analyzed separately because at Wave 3 the students of the main sample are surveyed for the third time, whereas students of the refreshment sample are surveyed for the first time. Thus, the participation decisions are not the same.

4.1 Wave 1

In Wave 1 students being educated in special-needs schools have a higher propensity to participate, see Table 7. Students having a native language other than German or who have missing values in this variable have a significantly lower propensity to participate.
Considering the joint participation decision of students and parents in Wave 1 the effects for students are as already discussed and only change slightly in magnitude, see Table 8. Parents participation decisions are positively influenced by having a child educated in a special-needs school and by having a child being part of the younger half of the age group. Their decision is negatively influenced by having a child who's native language is other than German or missing. The residual correlation is very weak and not significant.

4.2 Wave 2

In Wave 2 students being educated in special-needs schools have a lower propensity to participate, see Table 7. The effect of having another native language than German is not significant anymore and the effect of having missing values in the native language variable decreases in magnitude, though still negatively influencing participation decisions. Students being in the field of individual retracking (for various reasons) have a lower propensity to participate in Wave 2.
For students participating jointly with their parents the effects, as discussed above, remain stable and only change little in magnitude, see Table 8. Additionally we see that the positive participation decision of the parent in Wave 1 positively influences the students decision. Parents decision to participate in Wave 2 is influenced negatively by having a child being educated in a special-school, speaking another native language than German or having missing values in this variable, and by having a child that is surveyed in the field of individual retracking (for various reasons). A parent's decision is positively influenced by having participated in the previous Wave 1 of the survey. The residual correlation in Wave 2 is slightly positive, compared to Wave 1, and now also significant.

4.3 Wave 3

In Wave 3 students of the main sample being educated in special-needs schools have a lower propensity to participate, see Table 7. Here, the effect of being part of the younger half of the age group is significantly positive.[5] The effect of having missing values in the native language variable further decreases in magnitude and is still negatively influencing participation decisions. Students being in the field of individual retracking (for various reasons) have throughout a lower propensity to participate in Wave 2.
Because only 59 out of 2205 students of the refreshment sample do not participate in Wave 3 we do not find variables significantly influencing the participation decision. Thus, we only estimate the random intercept on the school level.

[5] Students are categorized by their month and year of birth into an older and a younger half according to the median age of the entire cohort.

For students and parents jointly participating in Wave 3 we also distinguish between students and parents being surveyed for the third time (main sample) and being surveyed for the first time (refreshment sample), see Table 8. For the main sample the students's and parent's participation propensities in Wave 3 are mostly influenced by the same variable as in Wave 2. Student's participation decisions are negatively influenced by being educated in a special-needs school, having another native language than German or missing values in that variable, and being in the field of individual retracking (for various reasons). The participation of a parent in Wave 1 also negatively influences a students participation decision, whereas in contrast, Wave 2 participation of a parent positively influences the decision. Here, the participation of a student in the previous wave is also a strong, positively related predictor for the participation decision in Wave 2. The parent's participation decision is negatively influenced by having a child being educated in a special-needs school and having another native language than German or missing values in that variable. The decision is positively influenced by the own participation in the previous waves, that is, Wave 1 and Wave 2, as well as having a child that did participate in the previous Wave 2. The residual correlation decreases in Wave 3 compared to Wave 2 but still is slightly positive.
For students and parents jointly participating in the refreshment sample there is a slightly positive but insignificant correlation. Again, for students none of the available variables was predictive for participation. Parents participation is negatively influenced by having a child with another native language than German and positively influenced if the child belongs to the younger half of the age group.

5. Calibration

To correct for sampling errors and undercoverage we use data from Official Statistics for post-stratification (Statistisches Bundesamt, 2011). We apply raking (Deville, Särndal, & Sautory, 1993) on the number of students by Federal State and school type. The information used for sampling was provided by Official Statistics and thus are measured in the same way. Because school types change over time we only have complete information on school type for Wave 1. Thus, yet only weights for Wave 1 are calibrated (`w_t1_cal`). Although Bayer, Goßmann, and Bela (2014) provide a generated school type variable based on information arising during the parent's CATI, this variable is incomplete.

6. Trimming and Scaling

With the aim of increasing statistical efficiency of weighted analysis, the adjusted design weights were trimmed. The general goal of weight trimming is to reduce sampling variance and, at the same time, to compensate for potential increase in bias. Trimming was performed using the so-called "Weight Distribution" approach (Potter, 1990). Here, design weights are assumed to follow an inverse beta distribution with a cumulative distribution function F_w. Parameters of the sampling weight distribution are estimated using the sampling weights, and a trimming level τ is computed whose occurrence probability is 1%, that is, $1 - F_w(\tau) = 0.01$. Sampling weights in excess of τ are trimmed to this level and the excess is distributed among the untrimmed weights. The parameters for the sampling weight distribution are then estimated again using the trimmed adjusted weights, and a revised trimming level $\tilde{\tau}$ is computed. The trimmed adjusted weights are compared to the revised level $\tilde{\tau}$. If any weights are in excess of $\tilde{\tau}$, they are

trimmed to this level, and the excess is distributed among the untrimmed weights. This procedure is iteratively repeated until no weights are in excess of a newly revised trimming level. To ease statistical analysis, the trimmed design weights are standardized with mean one.

7. Conclusion

This paper provides an overview on the sampling design applied for establishing the refreshment sample of students in Grade 7 and the corresponding derivation of design weights. Further, nonresponse adjustments based on selectivity analyses taking the cluster structure on the school level and correlation between students and parents into account are presented. These analyses highlight factors influencing the participation decision, where typical factors like native language, being in a special-needs school or being surveyed outside the institutional context of a school impact on the participation decision.

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Appendix

A. Tables

Table 1: Variables included in the weighting data for SC3 version 3-0-0 of the SUF

Variable	Applies to	Content
Identifier		
ID_t	all	Identifier for target person
ID_i	all	Identifier for the school the target person was initially sampled in
Design information		
tstud_st	all	Study number the target person was first surveyed in (A28, A56, A63, A30, A30A)
sample	all	Part of the sample the target person belongs to
stratum_exp	Main sample, Refreshment	Explicit sampling stratum referring to the school
stratum_imp1	Main sample, Refreshment	Implicit sampling stratum (school type according to sampling frame)
stratum_imp2	Main sample, Refreshment	Implicit sampling stratum (Federal State the school is located in according to sampling frame)
stratum_imp3	Main sample, Refreshment	Implicit sampling stratum (regional classification according to sampling frame)
stratum_imp4	Main sample, Refreshment	Implicit sampling stratum (funding according to sampling frame)
Design weights adjusted for initial nonresponse		
w_i	all	Weight for institution
w_t	all	Weight for target
Weights adjusted for wave-specific nonresponse, standardized		
w_t1	5,559 cases	Cross-sectional weight for targets participating in Wave 1
w_t1_cal	5,559 cases	Cross-sectional weight for targets participating in Wave 1, calibrated
w_t2	5,331 cases	Cross-sectional weight for targets participating in Wave 2
w_t3	7,114 cases	Cross-sectional weight for targets participating in Wave 3
w_tp1	3,850 cases	Cross-sectional weight for targets jointly participating with one parent in Wave 1
w_tp2	3,522 cases	Cross-sectional weight for targets jointly participating with one parent in Wave 2
w_tp3	4,249 cases	Cross-sectional weight for targets jointly participating with one parent in Wave 3
w_t12	5,071 cases	Longitudinal weight for targets participating in Wave 1 and 2
w_t123	4,516 cases	Longitudinal weight for targets participating in Wave 1, 2, and 3

w_tp12	3,239 cases	Longitudinal weight for targets jointly participating with one parent in Wave 1 and 2
w_tp123	2,683 cases	Longitudinal weight for targets jointly participating with one parent in Wave 1, 2, and 3

Table 2: Abbreviations for school types contained in the variable `stratum_imp1`

Abbreviation	**School type**
GS	elementary schools (*Grundschule*)
GY	schools leading to upper secondary education and university entrance qualification (*Gymnasium*)
HS	schools for basic secondary education (*Hauptschule*)
RS	intermediate secondary schools (*Realschule*)
IG	comprehensive schools (*Integrierte Gesamtschule*)
MB	schools with several courses of education (*Schule mit mehreren Bildungsgängen*)
FS	schools offering schooling to students with special educational needs in the area of learning (*Förderschule*)
SU	schools only covering the orientation stage (*Schulartunabhängige Orientierungsstufe*)

Table 3: Model estimating the participation propensities for contacted schools in the refreshment sample

	Estimate
(Intercept)	-0.486^{***}
	(0.003)
School type MB	0.410^{***}
	(0.003)
School type RS	0.146^{***}
	(0.003)
School type IG	-0.553^{***}
	(0.003)
School type GY	-0.112^{***}
	(0.003)
σ^2	0.691
Federal State	
Number of schools	374

Notes: Abbreviations are MB: Schule mit mehreren Bildungsgängen, RS: Realschule, IG: Integrierte Gesamtschule, GY: Gymnasium, and HS: Hauptschule being the reference category. To model institutional participation, the `glmer` function with a probit link provided by `lme4` package (Bates, Maechler, & Bolker, 2012) in R (R Core Team, 2015) was used.

***, ** and * denote significance at the 0.1%, 1% and 5% level, respectively. Standard errors are given in parentheses.

Table 4: Sample sizes (initial and panel) and participation rates for the different samples of SC3

	Sample size		**Participation**
Samples	Initial sample	Panel sample	**rate**
Main sample	10,686	5,870	54.9%
Migrant supplement	877	242	27.6%
Refreshment sample	3,944	2,205	55.9%
Total	15,507	8,317	53.6%

Table 5: Model estimating the individual propensities to participate in the panel for students of the refreshment sample used to derive adjustment factors for unit nonresponse adjusted design weights

	Estimate
(Intercept)	0.065
	(0.070)
Grade in German	0.190**
1 to 3	(0.061)
Grade in German	0.493
Missing	(0.411)
Grade in maths	0.044
1 to 3	(0.056)
Grade in maths	−0.937*
Missing	(0.422)
σ^2	0.175
School level	
Number of students	3,716

Notes: Reference categories are: Grade in German 4 to 6 and Grade in maths 4 to 6. To model individual participation, the `glmer` function with a probit link provided by `lme4` package (Bates et al., 2012) in R (R Core Team, 2015) was used.

***, ** and * denote significance at the 0.1%, 1% and 5% level, respectively. Standard errors are given in parentheses.

Table 6: Participation status for members of the panel cohort of SC3 by wave

Participation status	**Wave 1**	**Wave 2**	**Wave 3**
Participant	5,778	5,539	7,280
Temporary dropout	334	559	987
Final dropout	0	14	50
Total	6,112	6,112	8,317

Note: Wave 3 includes 2,205 cases from the refreshment sample. Of these cases 2,146 students are participants and 59 students are temporary drop outs.

Table 7: Models estimating the individual participation propensities for students in Wave 1, Wave 2, and Wave 3 of SC3 used to derive adjustment factors for adjusted wave-specific cross-sectional and longitudinal weights

	Wave 1	**Wave 2**	**Wave 3**	
	Main sample	Main sample	Main sample	Refreshment sample
(Intercept)	1.891***	1.726***	0.784***	2.022***
	(0.049)	(0.043)	(0.083)	(0.087)
Explicit stratum	0.032	−0.063	−0.011	
Grade 5 but not Grade 9	(0.134)	(0.119)	(0.172)	
Explicit stratum	0.498**	−0.392***	−0.323***	
Special-needs schools	(0.157)	(0.091)	(0.093)	
Age group			0.109*	
Younger half			(0.051)	
Native language	−0.202*	0.065	−0.075	
Other than German	(0.098)	(0.089)	(0.079)	
Native language	−4.067***	−0.753***	−0.698***	
Missing	(0.272)	(0.140)	(0.142)	
Reason for individual retracking		−1.203***	−0.396*	
Individualized main survey		(0.262)	(0.196)	
Reason for individual retracking			−1.334***	
Age group expired			(0.200)	
Reason for individual retracking		−1.466*	−1.699*	
School shut down		(0.638)	(0.688)	
Reason for individual retracking		−1.501***	−1.325***	
School refused		(0.136)	(0.115)	
Reason for individual retracking		−1.926***	−1.509***	
Switched school		(0.102)	(0.071)	
Student participated			0.921***	
In Wave 2			(0.073)	
Random intercept	0.045	0.076	0.092	0.105
School level	(0.212)	(0.277)	(0.303)	(0.325)
Number of students	5,870	5,856	5,823	2,205

Notes: Reference categories are: Explicit stratum (SC3: Grade 5 and Grade 9), Age group (older half), Gender (male), Native language (German), Student participated in Wave 1/2 (no), Parent participated in Wave 1/2 (no), Reasons for individual retracking (none, main survey). To model individual participation, the `glmer` function with a probit link provided by `lme4` package (Bates et al., 2012) in R (R Core Team, 2015) was used. ***, **, and * denote significance at the 0.1%, 1%, and 5% level, respectively. Standard errors are given in parentheses.

Table 8: Models estimating the joint participation propensities for students and parents in Wave 1, Wave 2, and Wave 3 of SC3 used to derive adjustment factors for adjusted wave-specific cross-sectional and longitudinal weights

	Wave 1		**Wave 2**		**Wave 3**			
	Main sample		Main sample		Main sample		Refreshment sample	
	Students	Parents	Students	Parents	Students	Parents	Students	Parents
(Intercept)	1.851***	0.540***	1.490***	−1.209***	0.614***	−2.365***	1.931***	0.026
	(0.037)	(0.026)	(0.048)	(0.044)	(0.080)	(0.102)	(0.056)	(0.039)
Explicit stratum	0.023	0.032	−0.085	−0.040	−0.021	−0.130		
Grade 5 but not Grade 9	(0.120)	(0.066)	(0.093)	(0.083)	(0.126)	(0.085)		
Explicit stratum	0.484**	−0.461***	−0.382***	−0.515***	−0.272***	−0.353***		
Special-needs schools	(0.153)	(0.056)	(0.073)	(0.074)	(0.074)	(0.082)		
Age group		0.135***			0.120*	0.138**		0.275***
Younger half		(0.035)			(0.049)	(0.048)		(0.055)
Native language	−0.197*	−0.446***	0.106	−0.167*	−0.056	−0.267***		−0.429***
Other than German	(0.095)	(0.054)	(0.086)	(0.073)	(0.074)	(0.077)		(0.077)
Native language	−3.977***	−0.796***	−0.645***	−0.195	−0.585***	−0.271		−0.478
Missing	(0.256)	(0.111)	(0.130)	(0.152)	(0.132)	(0.174)		(0.335)
Reason for individual retracking			−1.160***	−0.236	−0.283			
Individualized main survey			(0.250)	(0.309)	(0.191)			
Reason for individual retracking					−1.276***			
Age group expired					(0.147)			
Reason for individual retracking			−1.447*	−0.759	−1.553**			
School shut down			(0.569)	(0.645)	(0.587)			
Reason for individual retracking			−1.425***	−0.271*	−1.240***			
School refused			(0.095)	(0.122)	(0.081)			
Reason for individual retracking			−1.821***	−0.740***	−1.394***			
Switched school			(0.094)	(0.113)	(0.065)			
Parent participated			0.262***	2.542***	−0.167*	1.197***		
In Wave 1			(0.053)	(0.050)	(0.074)	(0.069)		
Student participated					0.844***	0.533***		
In Wave 2					(0.069)	(0.086)		
Parent participated					0.446***	1.892***		
In Wave 2					(0.072)	(0.062)		
Correlation parameter[a]	0.069		0.307***		0.226***		0.195	
	(0.049)		(0.075)		(0.063)		(0.103)	
Number of student and parent couples	5,870		,856		5,823		2,205	

Notes: Reference categories are: Explicit stratum (SC3: Grade 5 and Grade 9), Age group (older half), Gender (male), Native language (German), Student participated in Wave 1/2 (no), Parent participated in Wave 1/2 (no), Reasons for individual retracking (none, main survey). To model joint participation decisions, the `zelig` function with `bprobit` link provided by `ZeligChoice` package (Owen, Imai, Lau, & King, 2012) in R (R Core Team, 2015) was used.

[a] Correlation parameter from the model output is transformed according to Honaker, Owen, Imai, Lau, and King (2013).

***, **, and * denote significance at the 0.1%, 1%, and 5% level, respectively. Standard errors are given in parentheses.