TREE
Transitionen von der Erstausbildung ins Erwerbsleben
Transitions de l'Ecole à l'Emploi
Transitions from Education to Employment

UNIVERSITÄT BERN

Transitions from Education to Employment
Cohort 2 (TREE2)

TREE2 study design

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Introduction

This document describes the design and implementation of the TREE2 panel survey, the second cohort study in TREE's multi-cohort scheme. The document is published simultaneously with the first release of scientific use data on the cohort.[1] The document is addressed to:

- Readers who are generally interested in the TREE panel study and particularly in its second cohort TREE2;
- Academic scholars, teachers and students who wish to work with the TREE2 data;
- Academic scholars, teachers and students who have hitherto worked with the data of TREE's first cohort (TREE1, launched in 2000) and wish to do so with TREE2's data as well (for single- or cross-cohort analyses).

TREE is funded by the Swiss National Science Foundation's (SNF) as a social science research infrastructure and co-funded by the University of Bern. The study is hosted by the University of Bern as an inter-faculty study between the institutes of sociology and educational science.

[1] TREE (2021). Transitions from Education to Employment, Cohort 2 (TREE2), Panel waves 0-2 (2016-2018) [Dataset]. University of Bern. Distributed by FORS, Lausanne. https://doi.org/10.23662/FORS-DS-1255-1.
The release comprises data from the TREE2 baseline survey (2016) and the first two panel waves (2017 and 2018).

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1 TREE's multi-cohort design

TREE (Transitions from Education to Employment) is a multi-disciplinary longitudinal large-scale survey providing high-quality longitudinal data on educational and occupational pathways in Switzerland for the use within the scientific community at large. The source of the data is a multi-cohort panel study of school leavers who are first surveyed at the end of compulsory school at the age of approximately 15 to 16 years (see Figure 1).

The first TREE cohort (TREE1) was launched in 2000 and draws on a large national (compulsory) school leavers' sample (N>6.000) tested and surveyed on the occasion of Switzerland's then first-time participation in PISA.[2] Since then, the sample has been followed up by means of 10 panel waves, the most recent one conducted in 2019/20. Further panel waves are planned at five-years intervals. Today, TREE1 respondents have reached an average age of approximately 35 and been surveyed for a period of over 20 years, spanning from early adolescence up to early middle-age. The study thus has gradually grown into a full-blown life course survey (Gomensoro & Meyer, 2017; TREE, 2016).

Over the years and across a wide range of academic disciplines (e.g. sociology, economics, psychology, educational and health sciences), TREE1 has become an invaluable database for research on pathways and transitions of adolescents and (young) adults. Today, TREE1 is to be found among Switzerland's most widely used data infrastructures in the social sciences.

The second TREE panel study (TREE2) covers a comparable population of school leavers who left compulsory education in 2016. As its baseline survey, it draws on the AES 2016 (see chapter 3 for details), a national large-scale assessment of mathematics skills.[3] Since then, this second cohort of school-leavers has been re-surveyed four times at yearly intervals.

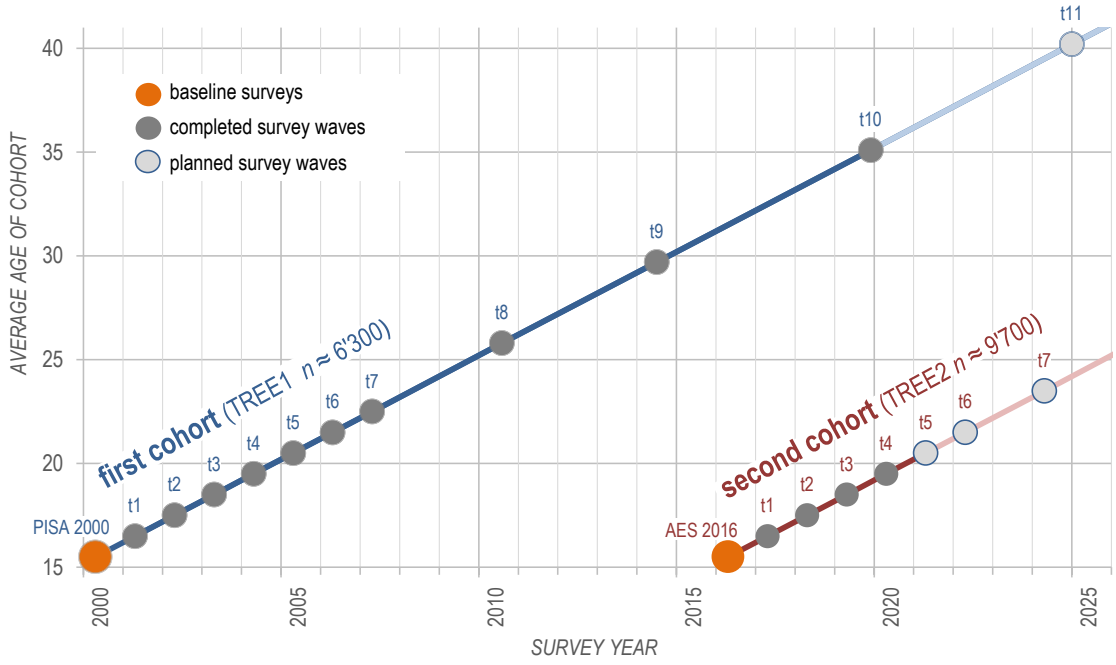
Along with detailed student background characteristics, the baseline surveys of both TREE cohorts provide elaborate measurements of cognitive skills which are at the respondents' command at the end of their compulsory schooling (9th grade).[4] The subsequent panel waves then collect detailed data on education and labour market pathways, which are contextualised by a rich set of complementary information on various life domains that have been identified in previous research as factors relevant for the respondents' later transitions from education into working and adult life. This allows researchers not only to analyse respondents' pathways in great detail, but also to examine how these context factors shape the observed pathways.

[2] Programme for International Student Assessment.

[3] Assessment of the Attainment of Educational Standards.

[4] 11th grade in the revised official numbering of grades, which includes two years of kindergarten.

Figure 1: TREE multi-cohort design



TREE2 adopts essential characteristics of the first cohort's (TREE1) design, which allows for inter-cohort comparison of how school-to-work transitions have changed over time (Gomensoro & Meyer, 2017; TREE, 2016). The two cohorts are comparable insofar as

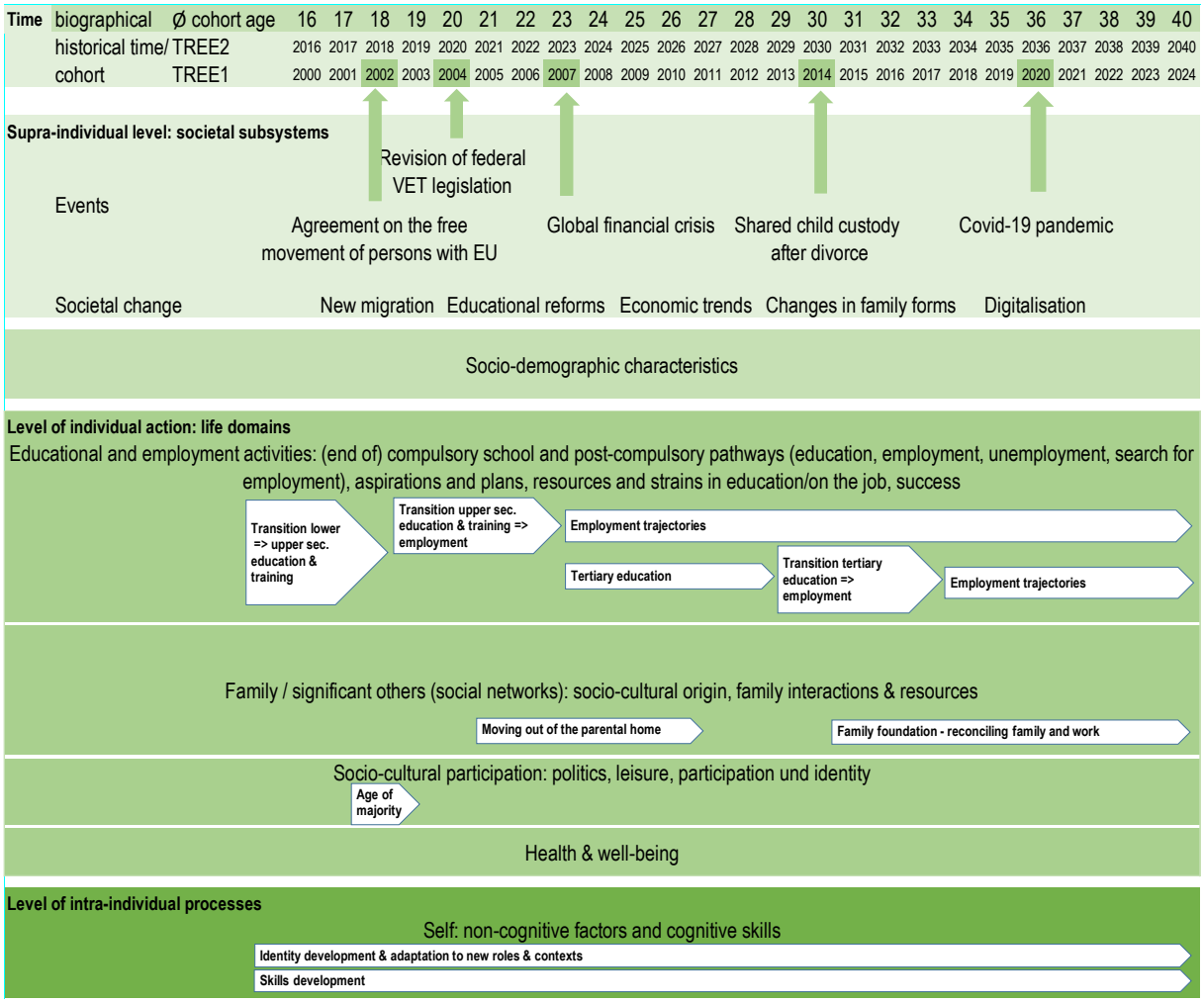
- they both are followed up on their pathways through upper secondary and tertiary education into gainful employment and young to middle adulthood;
- they both are followed up at yearly intervals up to age 22-23, and at looser intervals (2-5 years) later on, thus providing a dense and comprehensive observation of all relevant types of activities during school-to work transitions;
- they both draw on a baseline survey including elaborate assessments of cognitive skills acquired by the end of lower secondary education;
- the baseline surveys of both cohorts provide comprehensive measurements of students' starting conditions deemed to be relevant for their later educational and labour market pathways;
- they both draw on a large, nationally and regionally representative sample of students in their last year of compulsory education (i.e. at the end of lower secondary education). Moreover, survey participation of both baseline surveys is extraordinarily high (PISA 2000: 95 %; AES 2016: 93 %; see EDK, 2002; Verner & Helbling, 2019), which substantially facilitates measures to correct for non-response bias due to panel attrition.

2 Topics covered by TREE2's survey instruments

TREE focuses on post-compulsory education and employment trajectories of Swiss school leavers. At the end of compulsory schooling, young people need to make their transition into upper secondary education. In a country where two thirds of all school leavers enter vocational education and training (VET), this transition is very often tantamount to choosing a (training) profession and applying for an apprenticeship (training) place. However, this phase is also characterised by far-reaching developmental and identity-finding processes, which may also influence career choice. School-to-work transitions therefore must be analysed in the context of adolescents' psychological development and of the opportunity structures in which they make decisions and act.

The aim of TREE is not only to describe these trajectories in as much detail as possible, but also to find potential explanations for the different paths taken by young people. As an inter-disciplinary social science data infrastructure, TREE aims to include concepts from a broad range of disciplines and fields of study.

Figure 2: TREE2 survey dimensions from the perspective of Bernardi et al.'s life course cube



As an overarching theoretical framework, we draw on the life course paradigm (Baltes, 1990; Blossfeld, von Maurice, Bayer, & Skopek, 2016; Elder, 1994; Schoon & Silbereisen, 2009), which has been systematised by Bernardi et al. (2019) in a three-dimensional matrix accounting for temporal interdependencies as well as interdependencies between life domains (for more detail see Hupka-Brunner, Krebs-Oesch, Sacchi, & Meyer, forthcoming). Figure 2 adapts Bernardi et al.'s life course cube to the specific purposes of the TREE study. Along the various timelines (cohort age, biographical stages, historical time), we distinguish three levels of analysis: The supra-individual level (i.e. the societal macro-context), the level of individual action in various life domains and the level of intra-individual processes. Against the backdrop of the topmost level (which we do not measure directly), our survey instruments strive to cover, as comprehensively as possible, the (domain-specific) individual and intra-individual levels and their intricate interdependencies.

Against this macro-theoretical background, the aim of TREE2 is not only to obtain detailed information on post-compulsory education and employment trajectories of Swiss school leavers. TREE2 also aims at providing data on school-to-work transitions in the context of changing school, family, institutional, labour market and demographic conditions (Hupka-Brunner et al., forthcoming). Based on the life course paradigm and in accordance with TREE's multi-disciplinary character, the study's design strives to do justice to salient theories within the disciplines drawing on its data.

Table 1 provides a comprehensive overview of the topics and concepts covered by the TREE2 panel survey. It also illustrates whether a topic has already been covered by TREE1, thus highlighting the areas which are particularly well suited for cohort comparison, or whether a topic is new or has been extended and refined. For example, substantial additions and extensions have been made in the areas of family and (child)care, political and social integration, social networks, health and media use.

In the appendix of this document, we enclose a version of Table 1 which provides the sources we drew on for each concept adopted by TREE2, including a comprehensive bibliography.

Table 1: Topics covered by TREE2

Survey topics		**Comparability with TREE1**		
Main	*Detailed*	*(partly) comparable*	*extended or refined*	*improved time references*
Socio demographics	Socio-demographic characteristics and housing situation			
	Age and Gender	C		
	Civil Status	(C)		◷
	Housing situation	C	*	
	Composition of (own) family	(C)		◷
	Migration background and nationality			
	Migration background	C	*	
	Nationality, residence status		**	◷
Education. training and employment	Educational pathways and transitions (lower sec. level)			
	Educational biography (compulsory school)	C	(*)	
	Educational decisions (transitions lower => upper sec. education): perceived cost, benefit and chances of success		**	
	Educational objectives and aspirations	C	**	
	Plans for education and training	C	*	
	Characteristics of maths lessons (end of lower secondary education)		+	
	Educational situation and post-compulsory pathways			
	Attended educational programmes	C		◷
	Attended schools	C		◷
	Attended training firms	C		◷
	Skills requirements for educational activities / media use		(x) / *	
	Absenteeism / intention to change education	C		
	Resources and strains (education)	C	*	
	Credentials and marks	C	**	◷
	Reasons discontinuing education and training		**	◷
	Employment situation (incl. internships) and pathways			
	Employment / internships	C		◷
	Conditions of employment	C	*	
	Job position within company's hierarchy	C		
	Salary	(C)	*	
	Resources and strains (employment)	C	*	
	Job tasks, requirements and job-skills-mismatch	(C)	**	
	Absenteeism / intention to change job	C		
	Reasons for termination of employment		*	◷
	Self-assessment of education and employment pathways			
	Assessment of current education and training		**	
	Perceived fit and commitment: main activity (?)	C	*	
Other activities, job and training search	Search for education or employment			
	Search for education (end of lower secondary education)		*	
	Search for VET training place (upper sec.)	C	**	◷
	Job search (upper sec.)	(C)	**	◷
	Search for general education programme (upper sec.)		**	◷
	Other activities			
	Unemployment (unregistered and registered)	(C)	*	◷
	Vacation / holidays	(C)		◷
	Military service	(C)		◷
	Childcare (as main activity)	(C)		◷

Survey topics		**Comparability with TREE1**		
Main	*Detailed*	*(partly) comparable*	*extended or refined*	*improved time references*
	Illness / accident	(C)		🕒
	Maternity / paternity leave	(C)		🕒
	Gap / missing information	(C)		🕒
	Reasons for non-participation in education and employment			
	Reasons for non-participation in education and employment		*	
	Reasons for non-participation in education		*	
Family, significant others, social origin and networks	Family background			
	Family climate	C	*	
	Socio-economic origin	C	*	
	Social, cultural, and economic resources			
	Social capital (own)		*	
	Cultural capital (family of origin)	C	*	
	Cultural capital (own)	C	*	
	Economic capital (family of origin)	C	*	
	Financial situation (general)	(C)	*	
Social participation	Social and cultural participation			
	Politics	(C)	[**]	
	Leisure		**	
	Group affiliation and sense of belonging (identity)	(C)	*	
Well-being and health	Satisfaction and well-being			
	Satisfaction	C	*	
	School-related well-being		*	
	Critical life events	C	*	
	Health	C	[**]	🕒
Self	Non-cognitive factors			
	Motivational concepts	C	*	
	Self-perception	C	*	
	Emotions related to maths classes		+	
	Volitional strategies	C	*	
	Personality characteristics		*	
	Global preferences (risk, time and social preferences)		*	
	Values and attitudes	C		
	Attitudes related to maths classes		+	
	Cognitive skills (assessments)			
	basic mathematical skills	(C+)	**	
	reading speed		{**}	
	cognitive skills		{**}	

Legend for columns on comparison with TREE1:

C = Data (partly) comparable across cohorts. (C) Comparable data for both cohorts in upcoming data releases. (C+) Elaborated, but not fully comparable assessment of math competences available for both cohorts (TREE1: randomized split-half sample).

* Survey programme slightly extended compared to TREE1. ** Survey programme strongly extended compared to TREE1. + extended survey programme (AES topic). (*) = New data on transition primary school to secondary I not in this release. (^{x}) = Skill requirements surveyed in later waves (data not in this release). [**] New survey modules (web only) for randomised split half sample (see Figure 3, Section 3.1. {**} Assessment data (not in data release 2021).

🕒 Additional or refined data on the timing of activities, transitions or events in TREE2

With particular regard to cognitive skills, the following measurements were implemented at various points in time:[5]

- The elaborate AES assessment of mathematics skills conducted in the baseline survey (see Konsortium ÜGK, 2019);
- An assessment of general cognitive skills (KFT, see Heller & Perleth, 2000), administered in the baseline survey (AES extension survey, see Section 3.2.4);[6]
- A reading speed test administered in panel wave 1/2017 and from panel wave 3/2019 onward (SLS; see Gehrer, Zimmermann, Artelt, & Weinert, 2013; Zimmermann, Gehrer, Artelt, & Weinert, 2012).[7]

In addition to the topics listed in Table 1, several survey experiments have been implemented:[8]

- An experiment geared towards optimising the measurement of parental attainment of education was administered in the baseline survey (AES extension survey, see Section 3.2.4);
- An incentivised experiment to measure social value orientation (SVO) was administered in survey wave 2/2018 (Murphy, Ackermann, & Handgraaf, 2011; Werthmüller, 2020);
- A vignette experiment on high school[9] students' choices of field of study was administered in survey wave 2/2018.

Principles guiding the selection and development of survey instruments

In developing TREE2's survey instruments, we have systematically adhered to the principle of within-cohort longitudinal comparability of measurement, seeking to achieve a balance between new instruments and a core set of well-established TREE1 instruments that can be used for analyses focusing on comparison between cohorts. In the case of new instruments, preference was given to measures that have already proved their value in previous research (ideally in all administered survey languages). Important criteria were their conceptual relevance in research field-related theories, a well-established influence on important outcome dimensions, good

5 With the exception of the AES math test scores, the data of these additional elements are yet to be published in a future data release. In the meantime, the data may be provided upon individual request.

6 The test is designed to measure fluid intelligence and conclusive thinking. TREE2 employed the test's figural analogy module only (sub-test N2). Respondents completed the test of eight minutes in a web-based self-administered format developed by TREE.

7 Based on a paper-and-pencil version employed by the German National Education Panel Survey NEPS; duration: 2 minutes. Mode: self-administered web survey.

8 Beyond the listed experiments, we also conducted experiments on mode effects (paper-and-pencil vs. web-based CASI) and on incentivising with regard to respondents with increased risk of attrition.

9 I.e. students attending a Gymnasium or Kantonsschule (German-speaking Switzerland), a collège, gymnase, lycée or liceo (French/Italian speaking Switzerland).

measurement and/or scale quality as well as widespread use in other relevant surveys of our fields of research in order to enhance cross-survey comparability.

With particular regard to the longitudinal capture of trajectory and transition data, we have implemented further refinements of the dependent interview techniques already in use in TREE1, striving to yet improve coherence and reliability of the collected episodic data (Jäckle, 2009; Rudin & Müller, 2013). Moreover and in view of the numerous prospective measurements of psychological characteristics, we have developed a longitudinal concept that determines which instrument is going to be administered in which survey wave of the second cohort. To date, the concept comprises all panel waves up to the age of 30 (both completed and planned). The concept is guided by the following criteria:

- Short measurement intervals for characteristics that can be expected to change rapidly (low intra-individual stability);
- Measurements based on individualised timing shortly before and after relevant transitions and life events that are likely to be influenced and/or to depend on a given measurement dimension;
- Whenever possible, replication of measures administered in the corresponding waves of the first TREE cohort (TREE1);
- Reduction of individual survey burden and avoidance of questionnaire sequences that might appear repetitive and/or redundant to respondents.

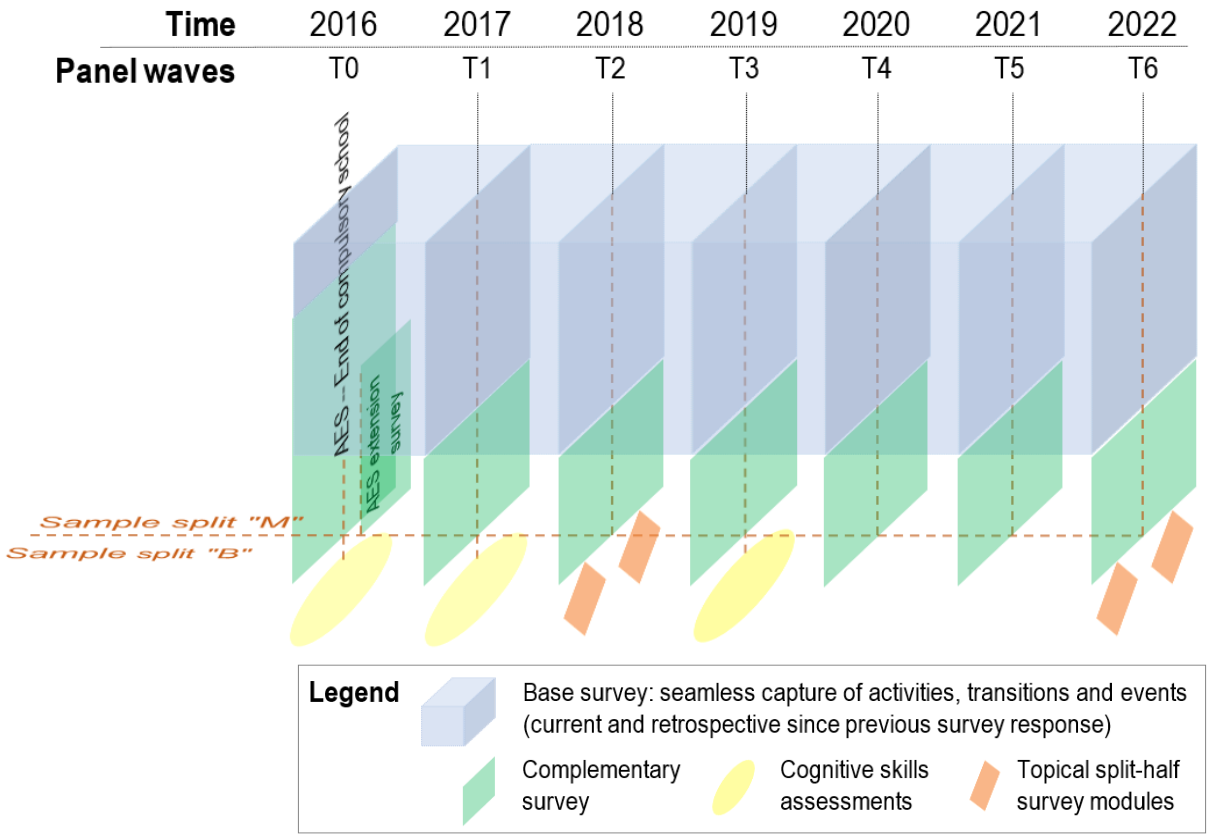
Selected characteristics are surveyed on the basis of an individualised, process-dependent timing. Crucial predictors of relevant outcomes are measured both cross-sectionally in selected waves (to estimate intra-individual changes) and at individualised points of measure shortly before a given critical transition.

3 Panel survey design

3.1 Overview

Figure 3 gives an overview of TREE2's panel design from its start (baseline survey in 2016) up to panel wave 6 in 2022. As is the case with the first cohort, TREE2 draws on the sample of a national large-scale assessment. While TREE1 drew on the Swiss sample of the PISA 2000 survey, TREE2 is based on a national survey conducted in the context of the Assessment of the Attainment of Educational Standards (AES), a mathematics skills assessment carried out in 2016 among students who were about to reach the end of compulsory school (9th grade).[10]

Figure 3: TREE2 panel design (up to panel wave 6)



Apart from an extensive mathematics test, the assessment includes a comprehensive student context questionnaire (for details see Section 3.2).[11] The questionnaire covers a wide range of measures geared to assess respondents' starting conditions in view of their subsequent post-compulsory education and labour market trajectories (see Section 2 for more detail). It also includes some retrospective elements regarding the transition from primary to lower secondary education as well as search and orientation activities related to the transition from lower to upper secondary education.

[10] 11th grade in the revised official numbering of grades, which includes two years of kindergarten.

[11] Administered, as all subsequent TREE2 follow-up surveys, in the three national languages German, French and Italian.

As an important part of the student questionnaire was administered to only one random split-half of the AES sample (split «B» in Figure 3), TREE conducted an extension survey among the other split-half (split «M» in Figure 3) shortly after the AES main survey. This allowed us to substantially extend TREE2's baseline sample (see Sections 3.2 and 3.5 for more detail). Beyond the questionnaire parts which had not been administered in the AES main survey, respondents of the extension survey also completed a general cognitive skills test (Heller & Perleth, 2000).

After the baseline survey, TREE conducted follow-up panel waves at yearly intervals in order to ensure a seamless observation of the TREE2 sample's wide range of post-compulsory trajectories. Educational, labour market and other activities were collected in CATI interviews relying on sophisticated dependent interviewing techniques (see Section 4 for more detail). In doing so, all relevant activities and transitions of the respondents are captured month-by-month. The CATI interviews are complemented by a subsequent self-administered questionnaire in which respondents, on the one hand, assess their educational or labour market activities in greater detail than they did in the CATI interview. On the other hand, they complete a wide range of self-assessing measures in areas such as family life, health and wellbeing, social and political integration as well as personality and self-perception (see Sections 2 and 4.3 for more detail).

Beyond the elements outlined above, the survey design is complemented, in specific panel waves and, in some cases, for specific (split-half) sub-samples by further cognitive assessment measures and topical survey modules (see yellow ovals and rust-coloured rectangles in Figure 3).[12]

3.2 Baseline survey

The Assessment of the Attainment of Educational Standards (AES) is a national monitoring scheme designed to capture student skills in mathematics, teaching and foreign languages at various stages of primary and lower secondary level education in Switzerland. The assessment surveys are tailored to national educational standards as defined by the HarmoS Agreement.[13]

As previously mentioned, the AES survey of 2016 serves as the baseline survey of TREE2. It is designed as a compulsory, cross-sectional in-school assessment, carried out under the responsibility of the Swiss Conference of Cantonal Ministers of Education (EDK/CDIP: see Konsortium ÜGK, 2019). In order to participate in the TREE2 panel, respondents therefore had to

a) give their explicit consent to being contacted by the TREE2 panel survey later on and
b) divulge their contact data on the basis of this consent.

The TREE2 baseline survey relies on the AES sample base and a questionnaire which was developed jointly and in close cooperation with the EDK. The data of the AES survey were collected by means of a computer-based classroom survey among a random sample of over 22,000 students

[12] The cognitive measures include a general cognitive and a reading speed test, the topical modules cover health and politics issues.

[13] For more detail, see https://swisseducation.educa.ch/en/harmos as well as www.icer.unibe.ch (in German, English and French) and http://uegk-schweiz.ch (in German, French and Italian).

(Verner & Helbling, 2019). Students in each tested school were gathered in ad hoc test classes and instructed and supervised by trained test administrators on the basis of a standardised test protocol. The survey included a computer-assisted self-interview (CASI) on a variety of student background characteristics of approximately 45 minutes, along with a comprehensive test of basic mathematical skills (adb, 2017; Angelone & Keller, 2019; Girnat & Linneweber-Lammerskitten, 2019).[14] The main field work of the AES was conducted between May and July 2016.

3.2.1 AES and TREE population definitions

The population covered by AES basically includes all students enrolled, in the school year 2015/16, in an 9th grade class of a school organised under Swiss school legislation. Irrespective of its degree of public funding, this also includes private schools. For survey-practical reasons, about three percent of the students were excluded from the AES (mostly students from schools for special needs; Verner & Helbling 2019).[15]

The population covered by TREE2 is almost identical to that of AES, with the exception that it excludes students who repeated their 9th grade in the school year 2016/17.[16] Limiting the TREE2 population to (compulsory) school leavers allows us

a) to direct the focus of our survey instruments for the subsequent panel waves on the specific biographical phase of post-compulsory education and

b) to maximise comparability of populations between TREE cohorts 1 and 2.[17]

3.2.2 AES sample design

From the population described above, AES drew a large, complex random sample of 22'423 students. The sample was drawn by means of a two-step, disproportionally stratified sampling procedure with schools as primary sampling units. In cantons with small student populations, all students were drawn. Stratification aimed at obtaining sufficient sample sizes for analyses at cantonal level, which leads to a marked over-representation of small rural cantons. Moreover, students enrolled in tracks with low academic requirements were privileged in the drawing of some cantonal samples. For a detailed description of the complex sampling design we refer to Verner und Helbling (2019).

[14] The test includes two test sessions of 50 minutes each.

[15] Apart from 2.1 percent of the population enrolled in special-needs schools, another 1.3 percent of the population were individually excluded on grounds of insufficient test language proficiency or physical or cognitive handicaps.

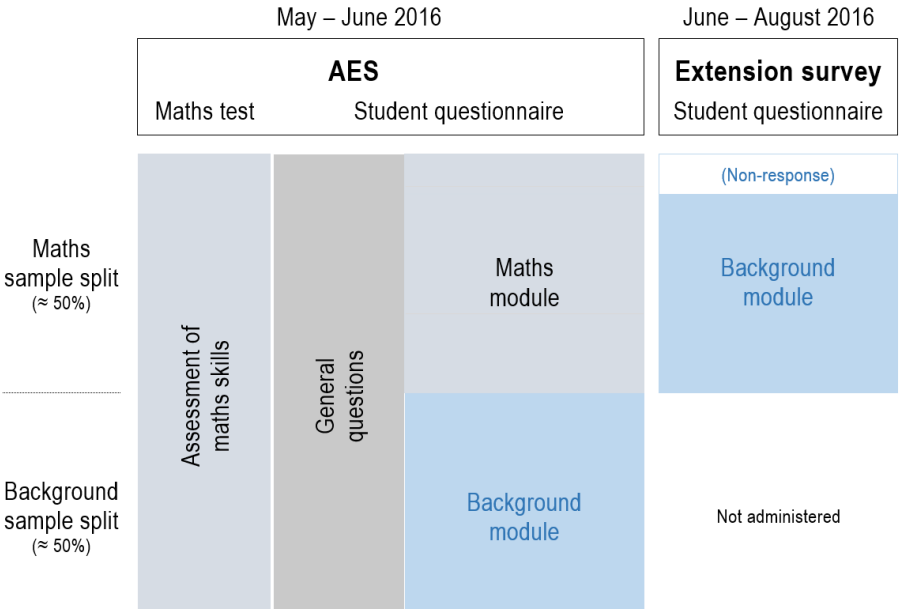
[16] That is, who did not complete their compulsory education by the end of the school year 2015/16. These (relatively rare) cases were retroactively excluded from the TREE2 panel (see Section 3.5).

[17] Unlike TREE2, however, TREE1 excludes school leavers from public schools outside Italian-speaking Switzerland from the population. On the other hand, the TREE1 population also includes a small number of early school leavers.

3.2.3 Modularisation of the AES questionnaire

With regard to the computer-assisted self-interview (CASI) administered by the AES, a modular design with two different variants of the student background questionnaire was implemented (Hascher, Brühwiler, Erzinger, Girnat, & Hagenauer, 2015; Hascher, Brühwiler, & Girnat, 2019; Hupka-Brunner et al., 2015; Sacchi & Oesch, 2017). Each questionnaire variant was administered to a randomised split-half of the total sample (see Figure 4).[18] The main building block of one variant was a mathematics module, which mainly covered student, teacher and classroom characteristics relevant to the successful acquisition of mathematical skills during compulsory education and to related didactical and pedagogical research. The core of the second variant was a student background module co-designed by TREE to collect information on a broad range of resources of the surveyed students, their families and the schools they were attending at the time of the survey. This module was developed in order to measure, as comprehensively as possible, the initial conditions deemed to be relevant for the respondents' further education and labour-market careers and their life courses in general. Both questionnaire variants included a common section («general questions») which was completed by all students participating in AES. The common section (about half of the questionnaire) incorporated items of general interest for the research objectives of both modules.

Figure 4: Modularised instrument design of the TREE2 baseline survey



[18] The randomised allocation of the two questionnaire variants was implemented by means of a disproportional cantonal stratification, in order to minimise the sampling errors with regard to analyses at national level for the sample split with the background module, while at the same time maximising the test strength for cantonal analyses on the part of the sample split with the maths module. For this purpose, the pronounced cantonal disproportionality of the AES sample (see previous Section and Verner & Helbling, 2019) was weakened in the first split and strengthened in the second split. Accordingly, the AES also provides special weights for analyses that are based on only one of the two sample splits.

Due to the modular design of the AES questionnaire, a substantial part of the questionnaire pertaining to relevant initial conditions of the post-compulsory pathways was administered to only one split-half of the AES sample. In order to close the resulting data gap for the other split-half sample, TREE conducted an out-of-school extension survey shortly after the AES main survey.[19] Owing to the extension survey, TREE was able to substantially extend the sample base of its second cohort.

3.2.4 The AES extension survey

The questionnaire of the extension survey basically replicates the survey programme of the background module in the AES main survey (see Figure 4). Two additional elements were placed at the end of the questionnaire: a brief test of general cognitive skills as well as an experimentally varied repeated measurement of parental education (see Section 2). In every canton, the extension survey started as soon as the AES main survey had been completed in all sampled schools. The interval between AES and extension survey was kept as short as possible in order to maximise data comparability. The median time lag between the AES and extension survey was 29 days. Field work started in June and largely ended in August 2016.[20]

In order to maximise survey participation, the extension survey applied a sequential mixed mode design (de Leeuw, Hox, & Dillman, 2008) with a self-administered web survey as its primary mode. Students who did not participate in the web survey received an equivalent paper-and-pencil questionnaire as a secondary mode (without the additional elements mentioned above), which accounts for approximately 13% of the total response. In order to further enhance participation, an unconditional a priori incentive of CHF10 (in cash) was included in the letter of invitation to take part in the extension survey.[21] With this mixed-mode design, the extension survey achieved a response rate of 73.3% (74.8 % when including incomplete questionnaires).

The implemented mixed-mode design is expected to yield high comparability of data both between the administered modes (de Leeuw, 2018; de Leeuw & Hox, 2011) and with regard to the AES main survey, which also relied on a self-administered mode (CASI). Furthermore, self-administered modes are also recommended to avoid social desirability biases (de Leeuw, 2018; de Leeuw & Hox, 2011).[22]

[19] The average lag between main AES and extension surveys was at 29 days. For more detail, see Section 3.2.4.

[20] The overwhelming majority of the respondents completed the questionnaire between June and August (98 %), with a few pencil-and-paper questionnaires being returned up to the end of October.

[21] Note that only respondents having previously consented to being contacted by TREE were asked to participate in the extension survey.

[22] We have thoroughly striven to optimise the extension survey with regard to maximum data comparability with the background module used in the AES. Nevertheless, it cannot be ruled out that the data comparability between the various subsurveys which are merged in the TREE2 baseline survey may be compromised by mode and / or setting effects. Our checks in this respect, however, indicate that these effects are virtually negligible (see Sacchi & Krebs-Oesch, 2021).

3.3 Subsampling and sample optimisation after the baseline survey

After completion of the baseline survey, a sample of 13,728 9th grade students had provided their contact details and their consent to being contacted by TREE at a later date. Due to restricted funding, we were not in a position to include all respondents providing their contact details for the TREE2 panel sample. In a first step, we therefore excluded most of the consenting respondents who had failed to complete the questionnaire of the extension survey.[23] In a second step, we excluded another 2,235 respondents by means of a randomized subsampling, leaving us with a gross panel sample of 9,741 students.

We used the subsampling to optimise the sample composition in view of the panel survey. The general idea was to privilege respondent groups of particular analytic value and/or groups known to be particularly affected by panel attrition. Privileged inclusion of these groups was achieved by either omitting them from the subsampling altogether (i.e. including them in the sample with a probability of one) or by assigning them an elevated sampling probability (Sacchi, forthcoming).[24]

3.4 Survey design of subsequent panel waves

3.4.1 Mixed-mode design

The mixed-mode design for the further panel waves (see Figure 5) relies on computer-assisted telephone interviews (CATI) as the main survey mode, which we expect to reduce non-response, especially for the disadvantaged part of the population with poor literacy skills and low academic achievement (see e.g. Beukenhorst & Kerssemakers, 2012; Sacchi, 2011). Above all, however, a carefully implemented CATI ensures high data quality for episodic data, which is a key focus of TREE. To this end, TREE has developed a sophisticated dependent-interviewing scheme in close cooperation with the survey institute mandated to carry out the field work (see Rudin & Müller, 2013). Compared to the CATI instrument administered in TREE1 (from wave 5 onwards), depth of observation and granularity of the data have yet been substantially improved in TREE2. This is particularly true with regard to data checks comparing present and previous responses, thereby further improving the longitudinal coherence and validity of the collected data (for more detail, see Section 4). To this end, the CATI interviews take recourse to information provided by

[23] With the exception of a small group (n = 74) of respondents with a particular set of socio-demographic characteristics being privileged in the subsequent subsampling procedure (see footnote 24).

[24] Technically, this was achieved by means of a disproportionately stratified random sampling based on social origin (privileging students of low social status and/or with migration background), type of lower secondary track attended (privileging students in tracks with low academic requirements) and educational plans for the time after compulsory school (privileging students which could be expected to experience precarious transitions from lower to upper secondary education).

Furthermore, the following groups were sampled with a probability of (i.e. included in the TREE2 panel sample without restriction):

(a) Students who completed the extension survey and the appended general cognitive skills test (KFT; see Section 2);

(b) Students with particular types of transition (e.g. 2-years VET programmes);

(c) Students belonging to the (small) Italian-speaking subsample.

the respondents in previous panel waves or, in the case of the first panel wave, to data collected in the baseline survey.

Figure 5: Mixed-mode design applied in subsequent TREE panel waves

Part of the survey programme [1]		Sequentially administered survey modes	
		Primary mode	Secondary mode
Base questions (part 1)	Focus on education and labour market pathways	*Computer-assisted telephone interview (CATI)*	*Self-administered paper-and-pencil base questionnaire*
Complementary questions (part 2)	Focus on prospective measures incl. sensitive questions [2]	*Self-administered web survey*	*Self-administered paper-and-pencil complementary questionnaire*

1) With parallel administration of different survey instruments and modes. 2) *Self-assessment, socially desirable behaviour etc.*

Respondents who cannot be contacted for a CATI interview (or who are not willing to be interviewed) are mailed a simplified self-administered paper-and-pencil version of the CATI instrument as secondary mode. This paper-and-pencil questionnaire essentially collects data on respondents' education and/or employment trajectories, including items measuring their satisfaction with the reported activities. With regard to part 1 of the survey programme displayed in Figure 5, the paper-and-pencil mode contributed approximately 4 to 5 percent to the total response in panel waves 1 and 2 (see Section 5 for more detail).

Participants of the CATI interview are asked to take part in a complementary survey, which is to provide additional information on respondents' current main activities and a wide range of further measures, including psychometric scales (e.g. self-assessments) and some sensitive questions that are susceptible to social desirability bias. Depending on their current main activities known from the CATI, respondents receive personalised versions of the complementary questionnaire, which are tailored to collect relevant in-depth information on these activities (see Section 4). In accordance with the recommendations of the methodological literature (particularly with regard to sensitive questions and social desirability bias), the complementary questionnaire is implemented by means of two self-administered modes which are activated sequentially (de Leeuw, 2008; de Leeuw & Hox, 2015; Kreuter, Presser, & Tourangeau, 2008).

The primary mode is a web survey that can be completed either on a computer or on a mobile device (responsive design). If respondents do not complete the web survey, they receive an equivalent paper-and-pencil version by mail (secondary mode). An overwhelming majority (81% in panel wave 1, 94% in panel wave 2) of the respondents completed the survey in the web mode, three out of four of them on their smartphones (see Section 5 for more detail). For technical and/or methodological reasons, some elements of the survey programme were administered in the web mode only.

3.4.2 Additional features of the survey programme

In addition to the recurrent survey programme administered regularly in the TREE2 panel waves, we included specific topical or time-dependent survey elements. In panel wave 2 (2018) we implemented two topical modules on health and politics, administered to one of the two AES sample split-halves each. The politics module also included an incentivised measure of social value orientations according to Murphy et al. (Murphy et al., 2011; Werthmüller, 2020).

Some data are collected on grounds of a particular point in time with regard to respondents' individual progress on their trajectory (e.g. their last year of a given educational programme). Items accounting for the individual situation can be expected to contribute, on the one hand, to improved data validity while, on the other hand, reducing overall survey burden (i.e. they are administered only to respondents to which a given situation applies). This pertains particularly to characteristics which can be expected to be predictive for subsequent transitions or activities (e.g. labour market entry or further educational trajectory).

Against this backdrop we implement, approximately one year prior to (expected) completion of upper secondary education, measurements of relevant self-concepts, educational aspirations, individual cultural capital as well as cognitive skills.[25]

3.5 Further sample adjustments, non-response, attrition and weighting

After the subsampling described in Section 3.3, we made the following retroactive adjustments to the sample of the TREE2 panel survey[26]:

- Individuals who did not participate in any of the panel waves 1, 2, or 3 were declared as permanent non-respondents and excluded from the sample (due to the low likelihood of obtaining a response, these individuals were/will not be contacted again in subsequent panel waves);
- Individuals who repeated 9th grade in the school year following the TREE2 baseline survey were removed from the sample because they do not belong to the population of the study as defined above);
- Individuals who failed to consent to their TREE2 panel data being linked with the data of the AES baseline survey were removed from the sample.[27]

[25] Reading speed test (SLS, see Zimmermann et al., 2012). The time-dependent measures are combined with (regular) wave-specific measures. This allows for analysis of intra-individual changes.

[26] As published in the data release 2021.

[27] The AES survey is a mandatory school survey, whereas participation in the TREE2 panel survey is voluntary. For reasons of data protection, respondents had to explicitly agree to the linkage of AES and TREE2 data. Respondents who failed to provide this agreement (be it by refusing it or by not replying to the respective question) had to be excluded from the released data. However, their data were used for the modelling of weights and scales. Data users wishing to consult these data may do so on particular request.

Table 2: Permanent sample drop-out and sample exclusions

Sample size	'Background' sample split	'Math' sample split	Total sample	(%)
Raw initial sample (after subsampling)	4,971	4,770	9,741	100.0%
Panel drop-out and exclusions (Wave 1-3)				
Never participated in wave 1 to 3	505	260	765	7.9%
Out of population (9th grade repeaters)	73	53	126	1.3%
No consent to link AES and TREE2 data	225	196	421	4.3%
Panel sample (as published/released in 2021)	4,168	4,261	8,429	86.5%

Details on these retroactive sample adjustments are listed in Table 2. They leave us with a total sample of 8,429 individuals (i.e. 14.5% smaller than the raw initial sample after the subsampling).

Table 3: TREE2 key response parameters, baseline to panel wave 2

	Fieldwork [1]	Initial sample	Response	
		(*n*)	(*n*)	(%)
AES survey (2016), including …	May - June			
▪ CASI survey		22,423	22,339	99.6%
▪ Consent to be contacted by TREE2		22,339	13,728	61.5%
AES extension survey (2016)	June - August	6,857	5,016	73.2%
Panel wave 1 (2017) [2]	April - July	9,741	8,252	84.7%
Panel wave 2 (2018) [2]	March - July	9,251	6,923	74.8%
Consent to link AES and TREE2 data (cumulative result waves 1-3)	/	8,850	8,429	95.2%

1) Period covers ≥ 98 percent of total response. 2) Without retrospectively excluded cases (see Table 2), survey participation rate is 81.8 % for wave 1, and 74.6 % for wave 2.

Table 3 gives an overview of the key figures regarding response from the baseline survey up to panel wave of 2. In view of the generally deteriorating response conditions in large-scale surveys (Olson et al., 2019), the realised response rates can be regarded as satisfactory.[28] It is particularly worth noting that, compared to the first TREE cohort, the rate of consent to be contacted by the TREE2 panel is substantially higher (62 vs. 55%). The panel wave-specific response rates, however, are lower than in TREE1. There are two main reasons for this:

- In the TREE2 panel, we have oversampled «critical» groups which are known to show increased risk of attrition;

[28] To a substantial extent, this is due to a.) innovations with regard to panel maintenance involving social media and b.) model-based, targeted incentives.

- Adolescents are particularly prone to the factors contributing to the general deterioration of response in large-scale surveys.[29]

Similar to other panel studies, TREE2 is affected by sample selectivity due to the various attrition processes summarised in Table 3 (for more detailed information, see Section 5). In order to compensate for all these processes as well as for design-based differences in probabilities of inclusion in the sample (AES sampling and sub-sampling), we provide wave-specific sample weights adhering to the principle of the inverse inclusion probability. The weights are based on differentiated modelling of all involved selection processes up to participation in a given panel wave. TREE2 data users are provided with a brief guide how to use these weights.[30] For a detailed description of the modelling and the calculation of the weights, a weighting documentation is under preparation (Sacchi, forthcoming).

3.6 Summary of distinctive features of the TREE2 design

To conclude, we would like to highlight the salient features of the TREE2 panel survey design of which we are convinced that they bear a high potential for a wide range of (explanatory) analyses:

- Fine-grained, seamless episodic data on educational and labour market activities combined with an abundant set of contextual data, including both retrospective and prospective measurements of respondents' individual characteristics, attitudes, assessments and dispositions;
- Comprehensive measurement of the respondents' starting conditions at the end of compulsory school (i.e. at baseline), including elaborate skills assessment (AES mathematics test);
- Outstanding response rate at baseline, allowing for exceptionally precise correction of panel attrition biases;
- A comprehensive set of survey instruments allowing for analyses covering a wide range of disciplines and theories and for regional as well as international comparisons;
- A multi-cohort design allowing for cohort comparisons across a period of 16 years (baseline years 2000 and 2016).

29 This is particularly true for the far-reaching changes of (tele)communication behaviours (Suter et al., 2018) as well as for the growing distrust vis-à-vis «unknown» calls and the technical possibilities to block them (Czajka & Beyler, 2016; Dillman, 2016; Jäckle, Gaia, & Benzeval, 2017). As a matter of fact, automatic call blockers have been a permanent major challenge when trying to establish contact to our respondents. To the best of our knowledge, we strove to circumvent call blocking, adopting various strategies including negotiations with commercial providers of call blockers.

30 See: Notes on weighting and variance estimation. In: TREE (2021). Transitions from Education to Employment, Cohort 2 (TREE2), Panel waves 0-2 (2016-2018) [Dataset]. University of Bern. Distributed by FORS, Lausanne. https://doi.org/10.23662/FORS-DS-1255-1 .

Contrary to TREE1 (which drew on PISA 2000 with a focus on reading literacy), TREE2 draws on the national mathematics skills assessment AES 2016 as baseline survey (see Section 3.2 for more detail). The two major advantages of AES are that

- it provides a substantially larger, more balanced baseline sample;
- it allowed TREE a substantially closer conceptual linkage of baseline and follow-up surveys owing to the joint development of survey instruments between AES and TREE.[31]

[31] The major disadvantage of the shift from PISA to AES is that the baseline surveys including the skills assessments are not fully comparable between cohorts.

4 Details on implementation and field work of the panel waves

4.1 Survey modes and dependent interviewing instruments

As outlined in Section 3.4, the TREE2 panel survey relies on a combination of computer-assisted telephone interviewing (CATI) and self-administered written questionnaires (web-survey). The CATI interview basically collects key data on education, employment and other activities as well as some socio-demographic data. Data on education, employment and other activity spells are being collected by means of dependent interviewing. Previously retrieved data on individuals' activities are fed into the CATI in order to be completed and updated for the entire period since the interviewed individual's last panel response (T*x-1* in Figure 6). The CATI design allows, in a carefully controlled negotiation process between interviewer and interviewee, to correct, complete and adjust erroneous, misleading or incomplete spell data collected in previous panel waves. The collected spell data also serve to determine which type of complementary questionnaire respondents are to complete in the second part of the survey: the latter is personalised in order to account for the type of main activity at the time of the CATI interview (e.g. various types of educational programmes, employment or other activities). For both parts of the survey, paper-and-pencil instruments are administered as secondary mode in case of non-response to the first mode (see Section 3.4.1).

When it comes to determine which data are best collected by CATI and which by self-administered web-survey, we apply the following main criteria (see also Section 3.4.1):

- CATI is given preference in the case of indispensable information used in most analyses as independent or dependent variable (e.g. socio-demographic and pathway characteristics or «outcome» variables such as diplomas or salaries).
- CATI is more suitable for capturing complex information, e.g. on discontinuous education and employment pathways. CATI, use by well-trained interviewers, allows for real-time plausibility checks during the interview as well as the handling of questionnaire items with a large number of nominal response categories (e.g. schools, firms, professions, etc.). This substantially improves data quality.
- Self-administered written instruments are more suitable for sensitive items (e.g. on drug consumption) and grid-formatted questions with an extended amount of text to be read – as they are often employed by standard psychometric scales.

  Furthermore, we account for the mode employed in the panel survey of the first TREE cohort for a given item: preference is given to mode coherence, i.e. collecting data on a given item in the same mode for both cohorts. In doing so, we avoid inter-cohort mode effects and improve cohort comparability.

4.2 Structure and content of the CATI interview

At the very beginning, respondents' date of birth, gender and name are verified in order to ascertain that the interview is conducted with the sampled target individual. The interview's introductory part also includes items on life domain-specific satisfaction and socio-demographic data (marital status, nationality, household composition, etc.).

The main part of the interview consists of capturing episodes (or spells) of relevant types of activity undertaken during the period since the last survey panel. Types of activity include education, employment, internships and other activities such as unemployment and search for employment, maternity leave, military service, childcare/domestic work (as main activity) and extended periods of illness.

Every episode is captured and stored as unit of observation in its own right and timed to the nearest month in terms of begin, duration and end. Throughout a given period of observation, a respondent may report *n* episodes of each type of activity mentioned above, and they may overlap in time (see Figure 6 for illustration). This allows for fine-grained sequencing of activities, be they parallel or consecutive.

Some additional specifications pertaining to a given episode are not continuous in character (i.e. relating to the entire duration of an episode), but «cross-sectional» in that they are only valid for the moment at which the specification is reported. An example for this are items on respondents' satisfaction with a given activity.

For **educational episodes**, the interview captures the following information:

- Date of begin and end (to the nearest month);
- Detailed specification of the educational programme attended;
- Detailed specification of the educational institution(s) in which the programme is attended; due to the «dual» character of many VET programmes involving several institutions for one single programme (usually at least a vocational school and a training firm), these specifications are captured as separate sub-episodes. This allows for fine-grained analysis of discontinuous pathways such as drop-out and/or change of training company or training profession.
- Volume of the attended programme (if not full-time);
- Satisfaction with attended programme(s), training institutions and teachers.
- Reasons for premature drop-out of a given programme.

Employment episodes include the following information:

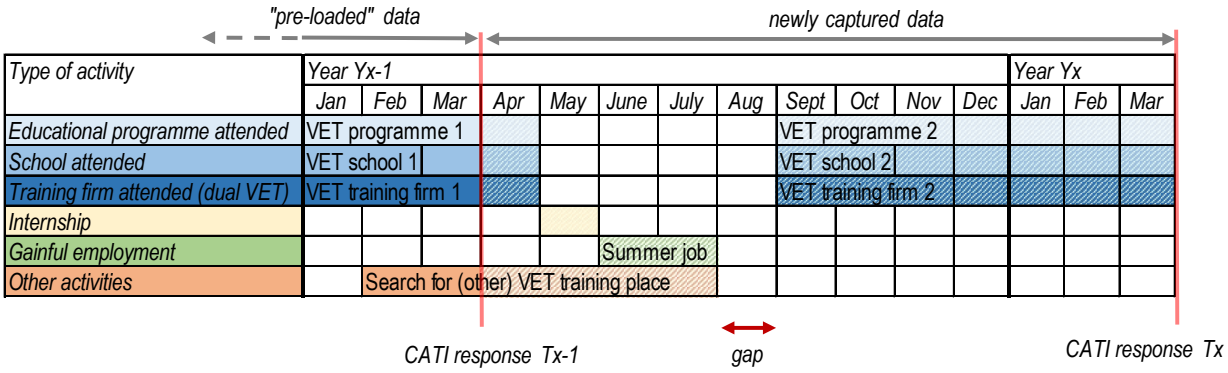
- Date of begin and end (to the nearest month);
- Detailed specification of job performed;
- Detailed specification of employer;

- Level of occupation;
- Contractual situation, precarious employment;
- Salaries and benefits;
- (Hierarchical) position in the employing company;
- Satisfaction with job and employer;
- Reasons for/conditions of termination of an employment spell;
- Conditions/sources of job search which led to employment spell in question.

The capture of **internships** depends on their character. If they are integral part of an educational programme, they are treated in the context of that programme; if not, episodic information is largely equivalent to that of employment episodes. Information on **other activities** is largely kept at a nominal level.

The proactive dependent interviewing scheme allows for the detailed capture of activity episodes on the basis of previously collected data. Its objective is a seamless coverage of all relevant activities undertaken, regardless of their beginning or end and of the moment of their capture.

Figure 6: Episodic capturing of activities in TREE2's dependent CATI interviewing

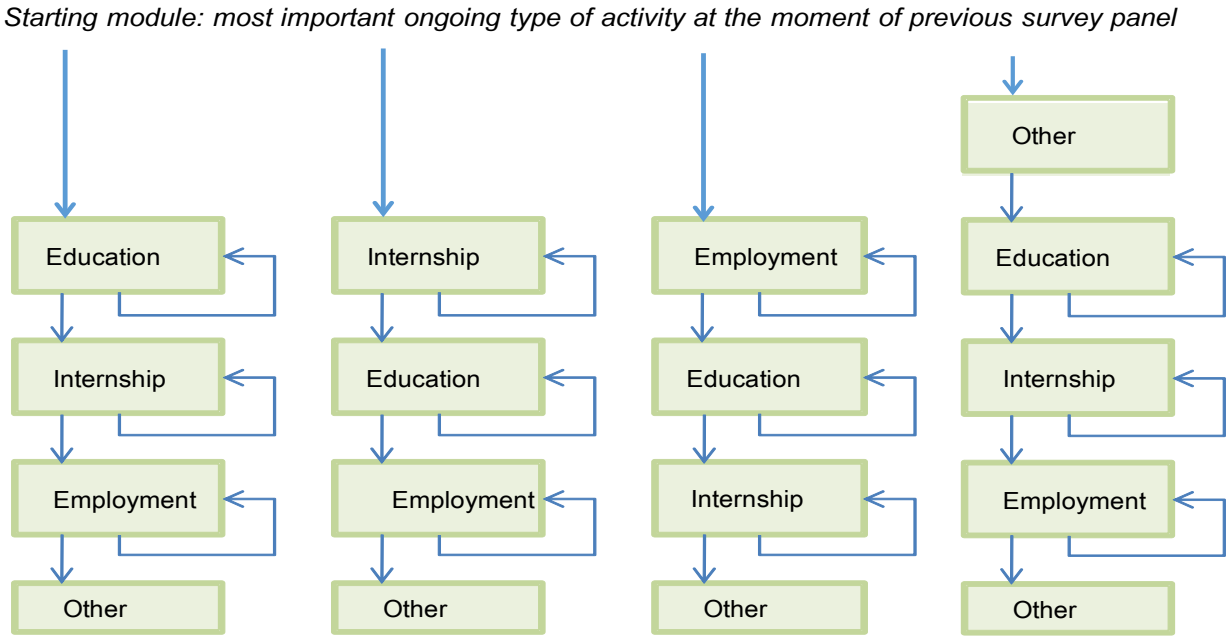


At the start of the interview, the interviewer has a screen on display which much resembles Figure 6. The red vertical line at the right of the graph marks the time of the current interview («CATI response T*x*»). Activity data collected in previous panel waves are preloaded into the CATI programme and displayed, month-by-month, left of the red line tagged «CATI response T*x-1*» («pre-loaded data») in Figure 6. The task of the interviewer now lies in recording all activity spells started, continued and/or ended between the moment of the previous survey and the ongoing interview (newly captured data between T*x-1* and T*x*, in the space between the two vertical red lines in Figure 6).

The interviewer basically proceeds by type of activity (see also Figure 7). On the one hand, he or she asks for an update on activities that have been ongoing at the moment of the previous panel wave. On the other hand, the interviewer records all new activity spells started since April of

year *Yx-1* (displayed in diagonally hatched colours in Figure 6). If the visualisation indicates gaps of one month or more without any recorded activities, an interview module is automatically activated in order to close this gap. Interviewees may wish, in the course of the interview, to correct, insert, cancel, replace, extend or otherwise adjust a given or yet new activity spell. Technically, interviewers are able to comply with that wish, provided that they observe the carefully defined «rules of change» they had been thoroughly briefed on during previous training. Furthermore, thorough real-time plausibility checks running in the background ensure the coherence and formal validity of the data throughout the interview, at the levels of both the individual spells and the sequencing/combination between them.

Figure 7: Individualisation and modularisation of episode capture



In order to achieve both a complete and correct set of recorded episode data and a reasonably coherent flow of the interview, the CATI programme provides a sequence of modules which takes the respondents' individual situation into account. If, say, a respondent had been in (ongoing) education at the time of the previous interview, the programme's algorithm will start with this education spell and then complete all education spells up to the ongoing interview. It proceeds to do the same with all other types of activity, passing on to internships, employment etc. (see Figure 7, leftmost column of rectangles).

Once all episodic data have been collected, a series of items designed to assess respondents' overall situation regarding their education, employment and other activities are administered, including their aspirations with respect to the future. The interview concludes with an item battery comprising information on respondents' housing situation, children, citizenship and residence status, rounded off with a thorough validity check of all contact data.

In the first panel wave they respond to after the baseline survey, interviewees also have to grant their explicit consent to the linkage of baseline data and data of the TREE2 follow-up survey(s). This is due to the fact that the baseline survey has been conducted in another (mandatory) institutional context and survey setting (AES, see Section 3.2). In such cases, Swiss data protection legislation requires said explicit linkage consent.

Immediately upon conclusion of the interview, respondents are sent a link to an individualised version of the survey's second part, the complementary questionnaire (CQ; for detail see following Section 4.3). Personalisation of the CQ depends on the main activity a respondent reports in the CATI interview. At this stage of the panel, (upper secondary) education activities are prioritised even if other types of activities are reported. If respondents are both in education and employment, the modules they are called to complete in the CQ are determined on the basis of the number of weekly hours they dedicate to either activity.

Individuals who fail to respond to the CATI are sent (after some reminders), a simplified and shortened paper-and-pencil version of the CATI as secondary mode. Given the sophistication of the CATI's dependent interviewing scheme, however, data collected by means of the paper-and-pencil version do not match the level of detail of the CATI.[32]

4.3 The complementary questionnaire

As outlined above, the complementary questionnaire (CQ) is administered in two modes: the primary mode is a web-based questionnaire[33], the secondary mode a paper-and-pencil variant which is largely identical to the web version.[34]

The main focus of the CQ is on the one or two current activities for which respondents invest most of their (working) time, e.g. an education and/or an employment. As outlined in Section 4.2, the definition of these activities is made on the basis of the activity spells data respondents have reported in the CATI interview. The main parameters of the relevant activities (e.g. educational programme, school and/or training firm attended or, in the case of employment, occupation and employer's name and location) are individually printed at the beginning of the respective questionnaire modules so that respondents know which activity they are called to refer to.

The education module is further subdivided in sub-modules which account for particularities of the educational programme attended by the respondents (especially with regard to dual VET,

[32] The share of response completed in this mode is at approximately five percent (see Section 5).

[33] The online questionnaire is programmed in an adaptive design, i.e. it can be completed on any electronic device connected to the internet (computer, tablet, smartphone). A large majority of the respondents completes the questionnaire on the smartphone.

[34] Exceptions basically concern survey elements such as skills tests and experiments which rely on technical features only available in the web mode. All types of complementary questionnaire are available as part of the published TREE2 datasets.

where a sub-module is dedicated to the training companies in which respondents attend the practical part of their programme).

The composition of the questionnaire is further personalised inasmuch as respondents are administered only the modules that concern them or their activities. The bulk of items administered in the respective activity modules aims to capture a detailed (subjective) assessment of respondents' learning and/or working conditions and environment (see Section 2 for details).

The general module (5) is administered to all respondents irrespective of their type(s) of activity.[35] It includes items and scales regarding health and well-being, significant others inside and outside the family, political and social integration as well as non-cognitive factors which are considered suitable to capture intra-individual processes and characteristics (see Section 2 for detail).

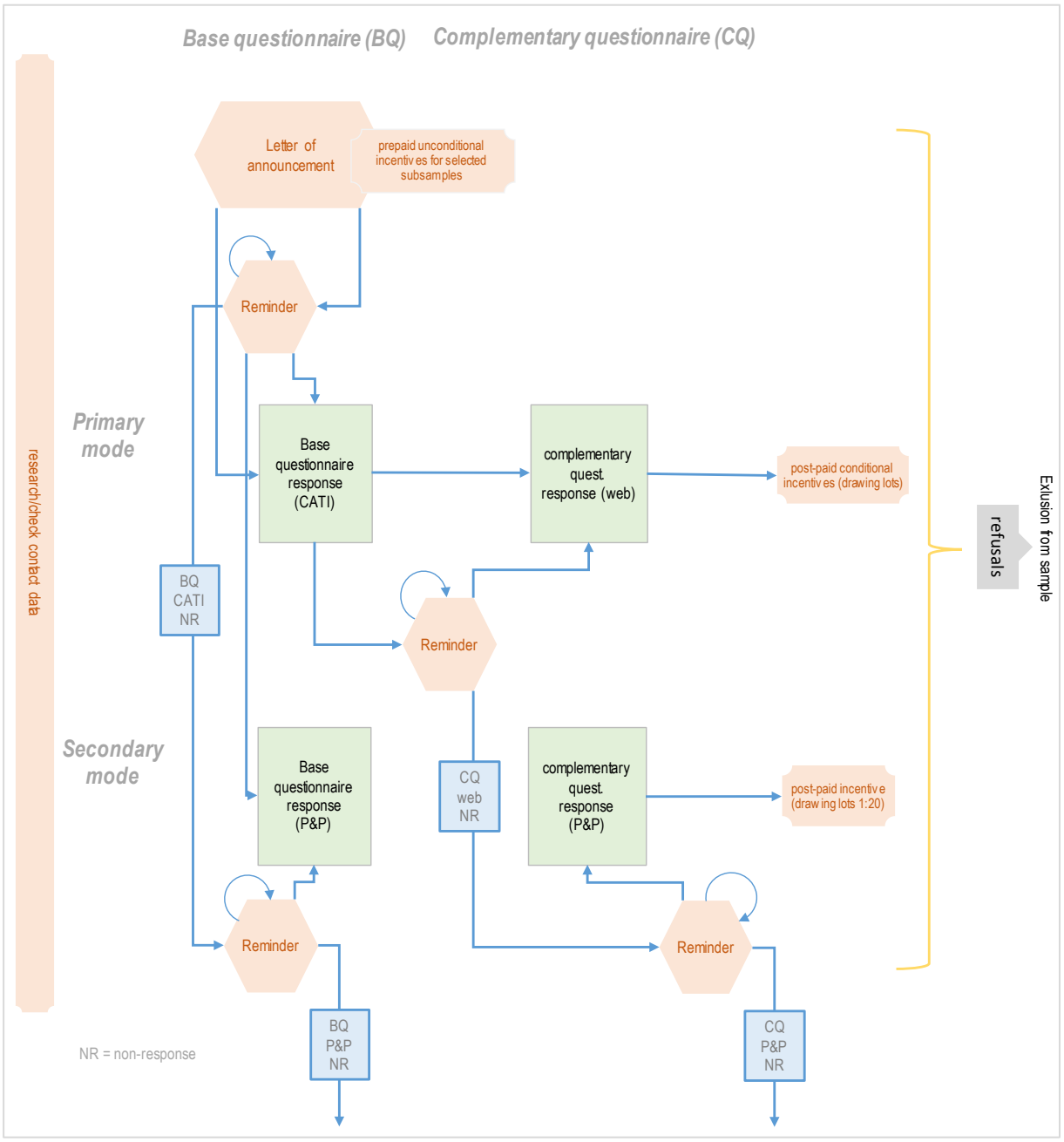
Respondents may be assigned the following combinations of modules:

1. Education module (with module school only), general module
2. Education module (with modules school and firm-based training), general module
3. Employment module, general module
4. Education module (with module school only), employment module, general module
5. General module only.

Beyond this basic structure, the CQ lends itself to the introduction of «add-ons» and further sub-modules such as short tests or (vignette) experiments, several of which have been implemented in the first few panel waves of TREE2 (see Section 2 for details).

[35] If respondents are neither in education or employment («NEET»), they will only receive the general module.

Figure 8: Field implementation of survey, mode and incentives design



4.4 Field work

4.4.1 Organisation, timing and sequencing of field interventions

Main field operation of each panel wave runs from late February or early March to early July (end of the Swiss school year).[36] A pretest in January/February ensures that adjustments of the complex survey instrument design are adequately and correctly implemented.[37] Field operation is largely mandated to M.I.S. Trend, a nationally operating Swiss survey institute with an excellent reputation in the field of large-scale scientific survey research. The mandate includes - always in close coordination/cooperation with TREE's survey management - programming of CATI and web-based CASI instruments, printing of personalised paper-and-pencil questionnaires, interviewer briefing, conducting the CATI interviews, maintenance of a hotline for each of the three survey languages[38], as well as mailing of announcement letters, paper-and-pencil questionnaires, incentives and (hardcopy) reminder letters.

A letter of announcement mailed out shortly before the start of the main field includes a newsletter, a prepaid reply card for contact data corrections and, for selected subsamples, a prepaid unconditional incentive worth CHF10 (cash or vouchers; see following Section for more detail). After that, field operations largely follow the process displayed in Figure 8. In view of the (multi-)media usage common among TREE2's young «digital native» population, field interventions such as announcements, reminders contact and interview scheduling management is conducted via various communication channels: (postal) mailing, e-mail, SMS, WhatsApp and telephone.

Given the high degree of mobility of the target population, contact data management efforts are crucial and extensive. Update and maintenance of contact data from previous panel waves are carried out drawing on various sources: automatized address updates offered by the Swiss postal services, requests at communal administrations, the reply cards mentioned above, and individual research on various Internet and social media platforms.

4.4.2 Incentives

Due to restricted funding, less than five percent of TREE's budget for survey expenses can be allotted to the payment of incentives. As distributing incentives to the entire sample is therefore not possible, TREE developed, on grounds of the available survey-methodological literature and some field experiments, a scheme of carefully targeted partial incentivising, both prepaid unconditional and post-paid conditional (see Figure 8).

[36] Depending on the cantons, the Swiss school year runs from mid-August or early September to the end of June or beginning of July of the following year. The timing of higher education programmes may deviate from this general schedule.

[37] To this end, we have a separate pretest sample of several hundred respondents at our disposal.

[38] German, French and Italian.

Prepaid unconditional incentives for selected subsamples amount to CHF10 and are paid either cash or in the form of travel vouchers.[39] Selection of subsamples to be incentivised relies on models predicting (non-)response on the basis of response patterns in previous panel waves.

Post-paid conditional incentives are disbursed in order to encourage completion of the complementary questionnaire, i.e. to reduce the number of respondents with incomplete data (see Section 5 for more detail). Due to the mentioned budget restrictions, this type of incentive is drawn by lot – with a probability to win of about 1:20. The value of the incentive is at CHF20-30 and is generally not paid in cash, but in the form of vouchers (e.g. cinema tickets).

We strive to compensate for the restricted incentives budget by offering respondents some further symbolic or «immaterial» benefits, first and foremost among them the above-mentioned newsletter.[40] The newsletter, edited in a language and form appropriate for the target group, informs on matters regarding the (next) panel survey, underlines the importance of (and TREE's gratitude for) their participating and provides respondents with intermediate study results. To be judged from respondents' feedback, the newsletter is highly appreciated and expected to substantially contribute to their willingness to further participate in the panel.

[39] So-called «Rail checks».

[40] See the TREE study's website www.tree.unibe.ch for examples (special pages addressed to the respondents, available in German, French and Italian only).

5 Response and attrition

As outlined in Section 3.5, response with regard to the baseline survey[41] is very high to almost complete (see Table 4). This is mostly due to the (mandatory) proctored classroom setting of the survey. The module-specific difference of 10 percentage points (89.6 vs. 99.6%) is explained by the fact that the background module was administered individually, on a voluntary basis and outside of this setting for half of the sample («extension survey», see Section 3.2.4 for detail).

Table 4: TREE2 sample response by waves and survey modes

Surveys	Survey year	Share of applied survey modes (%)[1)] CASI [2)]	CATI	Web	P&P [3)]	Overall response	Overall response rate [4)]
Baseline survey [5)]	2016						
AES core & math module		100.0%	/	/	/	11,887	99.6%
AES background module		57.8%	/	36.7%	5.5%	11,887	89.6%
Wave 1 (Base questionnaire) [6)]	2017	/	95.0%	/	5.0%	7,971	81.8%
Wave 2 (Base questionnaire) [6)]	2018	/	95.5%	/	4.5%	6,903	74.6%

1) As a percentage of the overall sample size. 2) Implemented in a proctored classroom setting. 3) Mailed paper-and-pencil questionnaire. 4) Response rate based on initial sample. 5) AES and AES extension survey combined. 6) I.e. without taking into account whether respondents have completed the complementary questionnaire.

Overall response rates for panel waves 1 and 2 range between roughly three quarters and over 80%. Note that the share of responses completed in the paper-and-pencil mode is only at approximately 5 percent. With regard to survey languages, close to 70% of the sample complete the German questionnaires, 25% the French and about 5% the Italian version (not displayed in tables). Variation of response across survey languages is negligible, both for base and complementary questionnaires.

Table 5: Response to complementary questionnaire by panel wave, mode and device

Complementary questionnaire survey	Survey year	Share of realised wave sample (%) Web by device: Computer [1)]	Smartphone	Web	P&P [2)]	Response [3)]	Response rate [4)]
Wave 1	2017	33.3%	47.9%	81.1%	18.9%	5,731	75.7%
Wave 2	2018	24.2%	69.4%	93.5%	6.5%	5,426	82.3%

1) Desktop, notebook or tablet. 2) Mailed paper-and-pencil questionnaire. 3) Includes incomplete questionnaires. 4) Participating share of initial sample (base questionnaire mode is CATI), including 6.5% and 4.8 % incomplete questionnaires for waves 1 and 2 respectively, including 6.5% and 4.8 % incomplete questionnaires for wave 1 and 2, respectively.

The share of CATI respondents who also completed the complementary questionnaire (see Table 5) is at 75.7% in wave 1 and at over 80% in wave 2. The respective share for CATI respondents

[41] Response rates of the baseline survey also take into account cases which, for reasons elaborated in Section 3.5, were excluded from the published/released data.

having completed the complementary questionnaire in *both* panel waves is at 64.5% (not displayed in table).[42]

The breakdown by device underlines the importance of smartphones when it comes to complete the (complementary) questionnaire. Their share, already substantial in panel wave 1 (47.9%) rose to almost 70 percent in panel wave 2 (69.4%). The share of all other devices and modes is accordingly decreasing.

Table 6: Detailed sampling, response and panel drop-out statistics up to panel wave 2

Sample size or percent (% in brackets)	AES split-half samples 'Background'	'Math'	Total sample
AES initial sample			22,423
AES CASI: unavailable / did not participate			84
CASI response rate			(99.6%)
AES Participants with CASI survey	11,208	11,131	22,339
No valid contact information	4,337	4,274	8,611
Contactable AES sample	6,871	6,857	13,728
Successful collection of contact details	(61.3%)	(61.6%)	(61.5%)
AES extension survey: Initial sample	/	6,857	/
Erroneously not contacted	/	11	/
Refusals before field start	/	24	/
Out of population [1)]	/	1	/
Refusals and nonresponse	/	1,805	/
Response (sample realised)	/	5,016	/
Response rate extension survey	/	(73.3%)	/
Panel refusals during extension survey	/	11	/
Full baseline survey sample	6,871	5,005	11,876
Subsampling after extension survey	1,900	235	2,135
Initial sample wave 1	4,971	4,770	9,741
Response wave 1 [2)]	3,914	4,057	7,971
Response rate wave 1	(78.7%)	(85.1%)	(81.8%)
Panel drop-outs between waves 1 and 2:			
Panel refusals [3)]	119	140	259
Consent on AES-TREE data linkage denied [4)]	61	48	109
Not in population (9th grad repeaters) [5)]	70	51	121
Out of population [1)]	0	1	1
Drop-out rate [6)]	(3.6%)	(3.9%)	(3.8%)
Initial sample wave 2	4,721	4,530	9,251
Response wave 2 [2)]	3,291	3,612	6,903
Response rate wave 2	(69.7%)	(79.7%)	(74.6%)

1) Deceased, no longer able to participate (accident, illness). 2) Base questionnaire completed (CATI or paper-and-pencil). 3) Between field start of waves 1 and 2. 4) Respondents with missing or ambiguous information on AES-TREE data linkage consent have been excluded from the panel after wave 3 (see Section 3.5). 5) The study population is restricted to students who left compulsory school after the baseline survey. 6) Share of panel or data linkage consent refusals.

[42] Respondents completing the paper-and-pencil version of the base questionnaire did not receive the complementary questionnaire.

Referring to Table 6, overall response rates can be regarded as satisfactory. Six out of ten respondents of the baseline survey (61.5%) agreed to be contacted by the TREE2 panel. Panel consent thus remains the most important single source for sample attrition and selectivity.

Note further that…

… the substantial sample reduction after the extension survey (-2,135 cases) was intentional in order to achieve a more balanced sample composition (see Section 3.3);

… selectivity of the two split-half samples varies considerably due to the additional survey burden of the math split-half (which is called to complete the additional extension survey). However, this variation has largely levelled out by panel wave 2;

… the number of panel drop-outs remains modest (259 cases between waves 1 and 2).

6 Data

After completion of each survey, collected data are stored in a relational database.[43] Raw data are stored in their own right so as comparison between raw and processed data is ensured at all times. For reasons of user convenience and data protection, raw data are not published, neither are sensitive data such as names, open text items, etc. Whenever possible, open texts are subsequently coded or cleaned to the extent that they no longer contain sensitive information and/or information compromising respondents' anonymity. As a general rule, data checks are restricted to formal consistency checks. Wherever possible, relevant nominal classifications are converted into nationally or internationally used classification systems (e.g. ISCED for education or ISCO/ISEI for occupations). Items used for building scales are subjected to thorough scale validity checks before publication of the respective scales values (see Sacchi & Krebs-Oesch, 2021).

As outlined in Section 4, TREE collects data at two (inter-connectable) unit levels of observation: the respondent level and the level of activity episodes (e.g. education, employment or other activities). The relation between the two levels is 1:*n*, i.e. each respondent can be related to the *n* episodes he or she reports. The main reference for all data on activities that respondents report is always the episodic data level. Every episode is assigned an identifier. Panel wave-specific activity statuses (and data related to them), i.e. characteristics reported at the time of the survey are always generated from the episodic data, so as to ensure consistency between the two data types/levels.[44]

Another important consistency check regards data from the complementary questionnaire (CQ). As outlined in Section 4, CQs are individually tailored to types of activity that respondents report in the CATI interview (e.g. various types of education, employment or combinations thereof). Respondents are then asked to assess a specific (main) activity in more detail in the CQ. In some cases, the activity reported in the CATI has to be adjusted (see above) and/or does not correspond to the activity which respondents are called to elaborate on in the CQ. Thorough plausibility and consistency checks are therefore performed to detect and correct these inconsistencies.

In the published datasets, episodic and wave-specific data are stored in separate files, which can be combined, on grounds of respondent and episode identification numbers, depending on specific research questions. Based on the checks described above, consistency between the two types of data is always guaranteed.

[43] TREE makes use of the open source database PostgreSQL.

[44] Note that an important part of plausibility checks of (episodic) activity data is performed at the time of the subsequent survey, where all previously reported activity spells are visible to the interviewers – and can be adjusted or corrected if the respondent says so. This is one of the main reasons why TREE data of a given panel wave cannot be published before data of the subsequent panel wave are available.

In the datasets containing episodic data, each episode (i.e.: case/record) contains variables specifying episode type, beginning, duration and end of a given activity, along with additional information on e.g. reasons and conditions of taking it up or ending it. Education episodes further include data on diplomas obtained at the end of the attended programme, while employment episodes contain, e.g., data on the starting salary. For obvious reasons, the number of episodes strongly varies between respondents. While respondent A may report only one education/training episode, respondent B may report no training episode, but two employment episodes running in parallel. If a respondent has failed to participate in a given panel wave, the CATI interview of the next wave in which said respondent participates captures all activities since the respondent's last response.

Contrary to the episodic data (which form a seamless temporal continuum), the panel wave-specific data only contain information on activities undertaken (and reported) at the time of data collection.[45] As in the episodic data, all activities are identified by a episode identifiers, allowing to combine the two types of data.

In the wave-specific datasets, records are sorted by a respondent identification number in order to facilitate data merging.[46] All wave-specific datasets contain the same number of cases/records (i.e. the number of individuals defined by the initial panel sample), irrespective of the fact whether respondents have participated in a given panel wave.[47]

The episodes in the TREE2 data are referenced to each other. Episode data thus can be linked not only with wave-specific data, but also among each other (principal and sub-episodes, see below). Each episode is marked with an episode identifier and a variable regarding the type of activity (education, employment, etc.). As outlined in Section 4 and visualised in Figure 9, education episodes are structured at two (further) hierarchical levels. This is due to the complex institutional setting of dual vocational education and training (VET), where learners attend a vocational school on the one hand and practical training at a training firm. VET learners sign a contract with a training firm, but contracting and training firm are not always one and the same.[48]

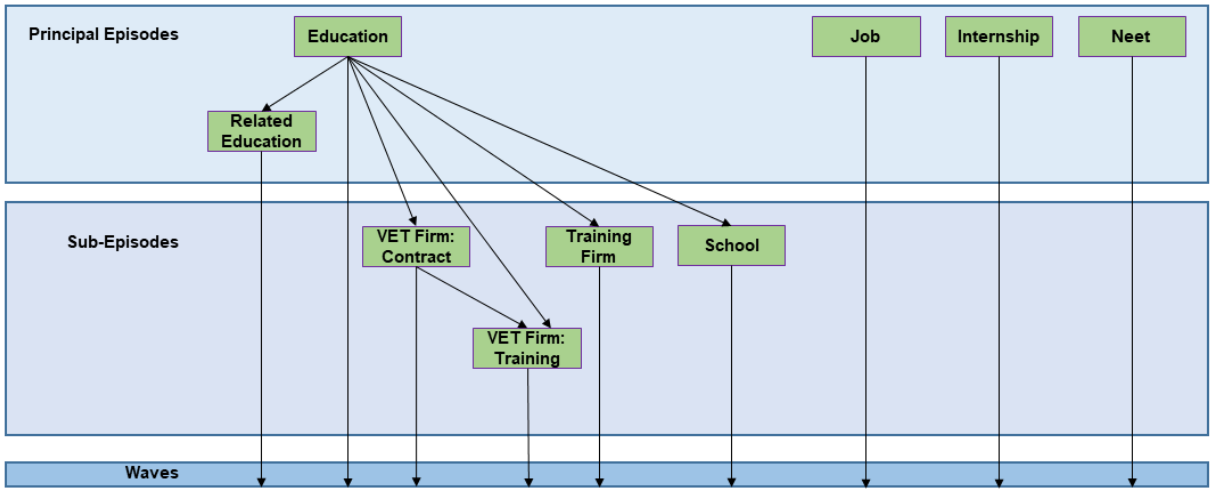
[45] If, for instance, a respondent reports activities undertaken in 2017 (only) on the occasion of panel wave 2018, these activities will be contained in the episodic data, but not in the wave-specific data of panel wave 2018.

[46] Naturally, this number is also contained in each record of the episodic dataset so that the relation between respondent and episode can be established at any time.

[47] Valid initial sample: 8,429 cases; see Section 3.5. Wave specific survey participation is marked by several variables in the data. Fort details see data documentation.

[48] This distinction is important when it comes to determine, e.g., whether a change of VET training firm is intentional/planned or due to dropout.

Figure 9: TREE2 episode reference system: overview



6.1 Ethical, privacy and protection standards of collected data

The TREE2 data collection, treatment and publication strictly complies with Swiss ethical and data protection legislation. A detailed data management plan has been submitted to and approved by the study's main funding institution, the Swiss National Science Foundation (SNF), (Jann & Becker, 2020).[49] Among other things, the plan guarantees

- Strict confidentiality with regard to collection, treatment and transfer of contact and survey data;
- Strict separation of contact and survey data;
- State-of-the-art security standards as to the (physical) storage and the treatment of data;
- Transparent communication of voluntariness of participation to respondents;
- Strict observation of respondents' consent to panel participation and data linkage;
- Thorough anonymization of published data.

[49] The DMP can be provided on request. It includes a data security concept approved and registered by the data protection authorities of the canton of Bern, where the TREE study is domiciled.
See https://www.jgk.be.ch/jgk/de/index/aufsicht/datenschutz/register_der_datensammlungen.html .

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Appendix: Sources of the TREE2 survey programme

Survey topics

Main	Detailed	Sources
Socio demographics	Socio-demographic characteristics and housing situation Age and Gender Civil Status Housing situation Composition of (own) family Migration background and nationality Migration background Nationality, residence status	DAB-Panelstudie (2020); Kunter et al. (2002); Mang et al. (2018); NEPS (2013); PISA 2000; PISA 2015; TREE, Verner and Helbling (2019)
Education. training and employment	Educational pathways and transitions (lower sec. level) Educational biography (compulsory school) Educational decisions (transitions lower => upper sec. education): perceived cost, benefit and chances of success Educational objectives and aspirations Plans for education and training Characteristics of maths lessons (end of lower secondary education) Educational situation and post-compulsory pathways Attended educational programmes Attended schools Attended training firms Skills requirements for educational activities / media use Absenteeism / intention to change education Resources and strains (education) Credentials and marks Reasons discontinuing education and training Employment situation (incl. internships) and pathways Employment / internships Conditions of employment Job position within company's hierarchy Salary Resources and strains (employment) Job tasks, requirements and job-skills-mismatch Absenteeism / intention to change job Reasons for termination of employment Self-assessment of education and employment pathways Assessment of current education and training Perceived fit and commitment: main activity (?)	Baumert et al. (2008) ; Beck et al. (2008) ; BIBB (2012); DAB-Panelstudie (2020); Dunckel (1999); Ganzeboom, De Graaf, and Treiman (1992); Ganzeboom and Treiman (2019); ICILS 2013/ Jung and Carstens (2015); International Standard Classification of Education (ISCED 2011); International Standard Classification of Occupations (ISCO-88); International Standard Classification of Occupations (ISCO-08); Kunter et al. (2002); Mang et al. (2018); Meyer, Allen, and Smith (1993); NEPS (2013); Neuenschwander et al. (1998); Neuenschwander et al. (2013); Nomenclature of the Swiss learner statistics (SFSO Swiss Federal Statistical Office); PISA 2000; PISA 2006 ; PISA 2012; Prümper, Hartmannsgruber, and Frese (1995); Seidel, Prenzel, and Kobarg (2005); Semmer, Zapf, and Dunckel (1999); Swiss Labor Force Survey (SLFS); Swiss Federal Statistical Office (FSO): Business and enterprise register (BER); Swiss Standard Classification of Occupations - SSCO 2000; TREE; Zapf et al. (1983);
Other activities, job and training search	Search for education or employment Search for education (end of lower secondary education) Search for VET training place (upper sec.) Job search (upper sec.) Search for general education programme (upper sec.) Other activities Unemployment (unregistered and registered) Vacation / holidays Military service Childcare (as main activity) Illness / accident Maternity / paternity leave Gap / missing information Reasons for non-participation in education and employment Reasons for non-participation in education and employment Reasons for non-participation in education	Swiss Labor Force Survey (SLFS); TREE

Survey topics

Main	Detailed	Sources
Family, significant others, social origin and networks	Family background Family climate Socio-economic origin Social, cultural, and economic resources Social capital (own) Cultural capital (family of origin) Cultural capital (own) Economic capital (family of origin) Financial situation (general)	Böhm-Kasper et al. (2000); Böhm-Kasper et al. (2004); DAB-Panelstudie (2020); EVS 1999/2000 / Halman (2001); Ganzeboom, De Graaf, and Treiman (1992); Ganzeboom and Treiman (2019); Girnat (2017); Hartley et al. (2016); Hobza et al. (2017): International Standard Classification of Occupations (ISCO-88); International Standard Classification of Occupations (ISCO-08); ISSP 2012/ Scholz et al. (2014 ;) Kunter et al. (2002) ; Mang et al. (2018); NEPS (2013); Szydlik (2008); PISA 2000; PISA 2012; TREE; WVS/EVS / Inglehart et al. (2000)
Participation in society	Social and cultural participation Politics Leisure Group affiliation and sense of belonging (identity)	GESIS (2008); ICILS 2013 / Jung and Carstens (2015); MOSAiCH 2013; MOSAiCH 2015; Stadelmann-Steffen and Koller (2013); SOEP Group (2019); Ernst Stähli et al. (2014); Ernst Stähli et al. (2015); TREE;
Well-being and Health	Satisfaction and well-being Satisfaction School-related well-being Critical life events Health	Anand and Hees (2006); ch-x 2014/2015 / Huber et al. (2015); German National Educational Panel Study (NEPS); NEPS (2013); Grob et al. 1991; Hagenauer and Hascher (2012); Hascher (2004); Nagel and Ehnold (2007); PISA Pretest 2014; Renner and Schwarzer (2005); Sen (1985); The Socio-Economic Panel (SOEP); SOEP (2008); Swiss Household Panel (SHP) (2017); TREE
Self	Non-cognitive factors Motivational concepts Self-perception Emotions related to maths classes Volitional strategies Personality characteristics Global preferences (risk, time and social preferences) Values and attitudes Attitudes related to maths classes Cognitive skills (assessments) basic mathematical skills reading speed cognitive skills	Angelone & Keller (2019) ; Baumert et al. (2008) ; Eder (1995); Eder (2007) ; Girnat (2015); Girnat (2017) ; Girnat (2018); Global Preference Survey (GPS) / Falk et al. (2016) / Falk et al. (2018); Grob and Maag Merki (2001); Hackman and Oldham (1980); Hascher (2004) ; ICILS 2013 / Fraillon et al. (2014) / Jung and Carstens (2015) ; IGLU 2001 / Bos et al. (2005); Kovaleva et al. (2012) ; Kunter et al. (2002); Moser et al. (1997) ; NEPS (2013); Pekrun, Goetz, and Frenzel (2005) ; PISA 2000; PISA 2012 ; Rammstedt and John (2007); Rammstedt (2013); Rosenberg (1979) ; Roy (1995); Ryan and Connell (1989) ; Schmidt and Kleinbeck (1979); Schwarzer and Jerusalem (1999); Schwarzer (1999); Schwanzer et al. (2005); Schwarzer (2014); The Socio-Economic Panel (SOEP) (2008); Spinath et al. (2002); Swiss Household Panel (SHP) (2017); TREE Watermann (2000);

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