



TwinLife

TwinLife Technical Report Series

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Documentation TwinLife Data: Report Cards

v2.0.0

by Jana Instinske, Theresa Rohm, Sophia Mattheus,
Alexandra Starr, Rainer Riemann

instinske@uni-bremen.de





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TwinLife “Genetic and social causes of life chances”
University of Bielefeld
Faculty of Sociology
PO Box 100131
D-33501 Bielefeld
Germany

Phone: +49 (0)521 106-4309
Email: martin.diewald@uni-bielefeld.de
Web: <https://www.twin-life.de>

Table of Contents

Change log v2.0.0	1
Introduction.....	2
General Overview of the German School System	2
Different School Types of the German School System.....	4
Primary School (Grundschule)	4
Entry Into the Multi-Tier School System	4
Lower Secondary School (Hauptschule)	4
Intermediate Level Secondary School (Realschule).....	5
Upper Secondary School (Gymnasium)	5
Comprehensive Secondary School (Gesamtschule)	6
Other School Types	6
Data Collection and Encoding System	7
Data Collection	7
Encoding System	9
Further Variables on Educational Attainment	12
Handling of Missing Data.....	13
References.....	14
Literature.....	14
Internet-Resources	14
Further Reading	14
Appendix.....	16
Appendix A.....	16
Appendix B.....	17

List of Figures and Tables

Figure 1. Overview of the German School System	3
Table 1. Encodings and Frequencies of the Applied Survey Methodology of the Report Card Data (Variable cer0001) by Person Type.....	9
Table 2. Encoding of School Types	10
Table 3. Senior Grades in Gymnasium and Gesamtschule.....	11
Table 4. Encoding of Leaving Certificates	11
Table 5. Missing Values	13

Change log v2.0.0

Compared to the previous version (Mattheus et al., 2021), the following changes have been made in v2.0.0:

- Information on the applied survey methodology was improved, including the usage of alternative questionnaires
- Information on the children and parental reports was enhanced
- An overview of frequencies and comparability of available variables was added
- Information on the encoding of missing values was refined
- Information on the target respondents was advanced
- Improvements of the English translations of German school types were made
- Minor changes concerning the formatting and wording were made

Introduction

Due to the federal system and a long historic tradition, the German school system is quite complex. It is characterized, for example, by early selection and track placement at secondary school (in most German federal states after 4th grade) based on students' abilities and interests. Thus, we start this technical report with an in-depth description of the German school system before we explain the actual collection, usage and encoding of the report card data in TwinLife.

General Overview of the German School System

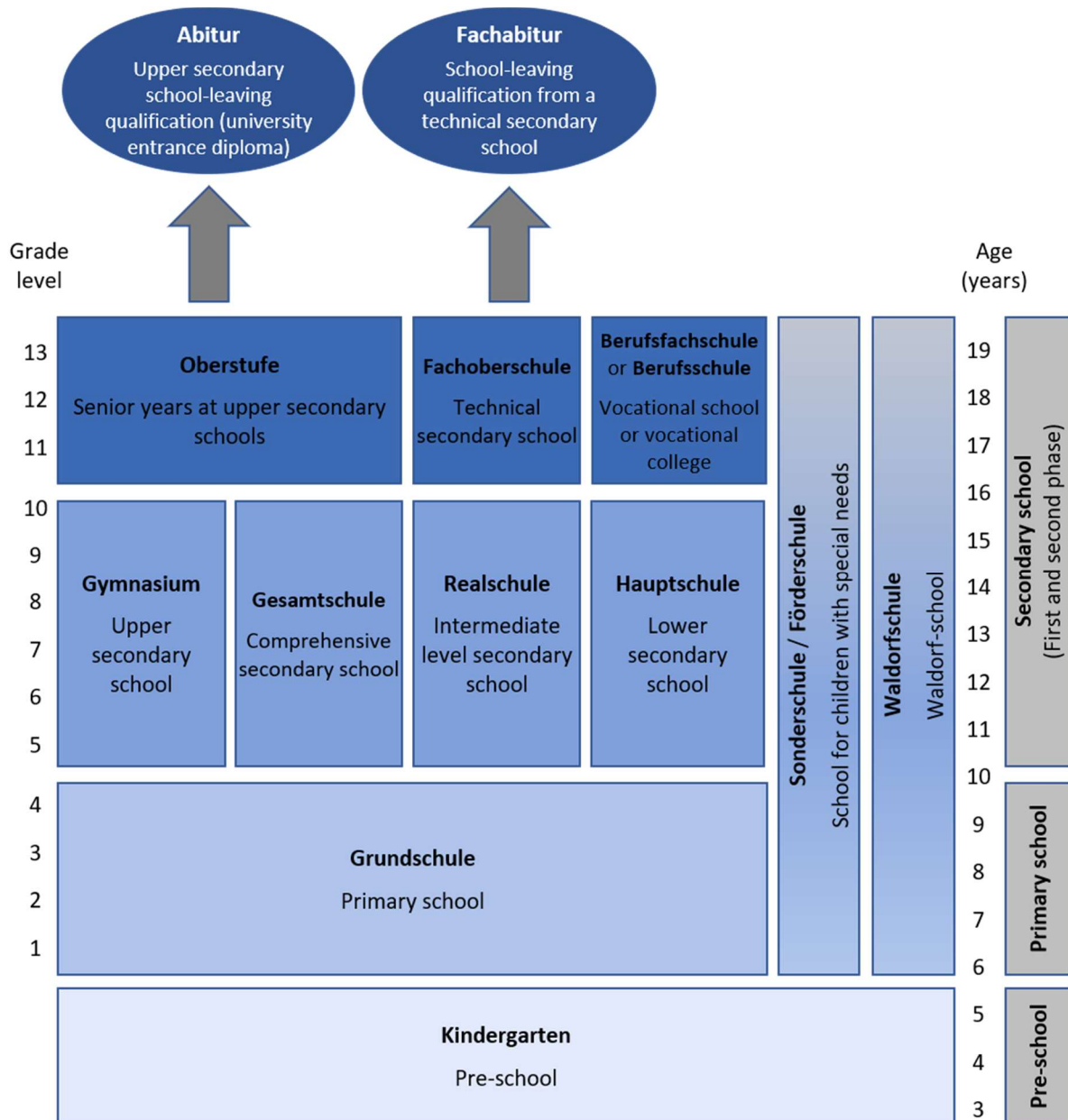
School attendance is compulsory for all children living in Germany from the age of six. At this age, children normally start to attend school. Compulsory education usually lasts until the end of the school year in which the child turns 18 years old. Unlike other countries, home schooling is not allowed in Germany. Children are required to attend public schools or approved private schools. The rules governing compulsory schooling vary between the federal states of Germany (*Bundesländer*). After pre-school (*Kindergarten*) and primary school (*Grundschule*), students visit different school tracks, which are divided into upper secondary schools (*Gymnasium*), comprehensive secondary schools (*Gesamtschule*), intermediate level secondary schools (*Realschule*), and lower secondary schools (*Hauptschule*). A general overview on German school types, their English translations, the respective grade levels and students usual age per grade level is presented in Figure 1.

Standard school subjects include mathematics, German, English and in addition further languages, social studies, natural sciences, arts, and physical education. Although education is a responsibility of the federal states and there are differences from state to state, some generalizations can be made. In the following, the structure of the German school system is explained in greater detail with a focus on presenting the most common school types and its differences concerning the level of education.

The German school system uses a 6-point grading scale to evaluate the performance of school children. Grades vary from 1 (excellent, "*sehr gut*") to 6 (insufficient, "*ungenügend*"). These grades are not only used to describe students' general performances in subjects, but also to decide upon their placement within and between schools. If students achieve grades that are not sufficiently high (e.g., failure in two or more subjects), they have to stay down a year and repeat the contents in all subjects or switch to a lower-level school type (e.g., from *Realschule* to *Hauptschule*).

Figure 1

Overview of the German School System



Note. The displayed English translations refer to the labels assigned to school types in variable cer2003g.

(Own illustration based on <https://www.howtogermy.com/pages/germanschools.html>)

In some states, not only the students' academic performance is evaluated, but also other qualifications such as social behavior skills, participation in class and motivation that are referred to as *Kopfnoten*. They are called *Kopfnoten* because they used to be listed in the head of the certificate prior to the other grades. They are usually divided in at least two assessments,

but depending on the state, further subdivisions are common. The *Kopfnoten* are either assessed through numerical grades (on four- to six-point scales) or through written statements.

Different School Types of the German School System

Primary School (Grundschule)

From grade level 1 to 4, children attend primary/elementary school (*Grundschule*), where the subjects taught are the same for all children. In the states Berlin and Brandenburg, primary school also includes grade 5 and 6, called orientation level for secondary education (*Orientierungsstufe*). It is an orientation level for secondary education, where children are taught in different groups in the subjects German, Mathematics and English depending on their proficiency level. However, high-achieving students can leave primary school before sixth grade to switch to *Gymnasium*. Sometimes, children receive a written feedback at the end of the term instead of grades. The awarding of school grades in all subjects usually begins in the third school year of primary school.

Entry Into the Multi-Tier School System

After the 4th grade, children attend one of four different types of schools: *Hauptschule*, *Realschule*, *Gymnasium* or *Gesamtschule*. For the transition from primary to secondary school, primary school teachers recommend their students for a particular school type based on their academic achievement (averaged grade over all or some major school subjects), self-confidence and ability to work independently. In most German federal states these recommendations are not binding and parents have the final say which of the following school types their child will attend after fourth grade. However, in some German federal states (e.g., Bavaria, Thuringia, Brandenburg) the teacher recommendation is binding. This early selection process characterizes the German school system in contrast to other countries.

Lower Secondary School (Hauptschule)

The *Hauptschule* (grade levels 5 to 9/10) mainly teaches the same subjects as the *Realschule* and *Gymnasium*, but at a slower pace and with some more vocational-oriented courses, e.g., home economics, business and employment studies and technology. Students graduate after grade 9 and receive a lower secondary school-leaving qualification (*einfacher Hauptschulabschluss*) as graduation. Alternatively, they take an additional examination after grade 10 to acquire a higher qualification (*qualifizierender Hauptschulabschluss*). Both can

lead to part-time enrollment in a vocational school (*Berufsschule*) combined with apprenticeship training until at least the age of 18 years.

Intermediate Level Secondary School (Realschule)

The *Realschule* (grades 5-10) leads to part-time vocational schools and higher vocational schools. The students can select different compulsory subjects, either a natural scientific or technical subject, an economic or social science course or a second language.

It is possible for students with an above-average leaving certificate at the *Realschule* (*Fachoberschulreife*) to switch to a technical secondary school (*Fachoberschule*) where they can obtain an entrance qualification for the university of applied sciences (*Fachhochschulreife*) or to a transitional period at a regular *Gymnasium*.

In some cases, *Hauptschule* and *Realschule* are combined into one school type of integrated lower and intermediate level secondary school (*Verbundene Haupt- und Realschule*), which is in some states also called middle school (*Mittelschule*), where students can achieve both leaving certificates depending on the courses they attend. Please note, the middle school of the tracked German school system is not equivalent to the middle school in the United States school system.

After graduating from *Hauptschule* or *Realschule* (or after receiving an equivalent leaving certificate from another school type), students usually have not reached the age of 18 yet, so school attendance is still compulsory. Students starting an apprenticeship training thus enroll in a part-time vocational school (*Berufsschule*). This program is called dual vocational training (*Duale Berufsausbildung*) and takes from two to three and a half years. As another possibility, students enroll in a full-time vocational college (*Berufsfachschule*) to start a school-based vocational training (*schulische Berufsausbildung*), usually lasting one to three years. If students do not directly enter a vocational training, they start a vocational preparation training (*Berufsfachschule ohne Berufsabschluss*).

Upper Secondary School (Gymnasium)

Students attend *Gymnasium* for eight or nine years (depending on the state) to achieve a final qualification, the upper secondary school leaving certificate (*Abitur*), which is regarded as a certificate of aptitude for higher education (e.g., university entrance qualification). In the senior years of *Gymnasium*, students attend two types of courses: Advanced placement courses (*Leistungskurse*) and basic courses (*Grundkurse*). They choose the subjects of their advanced

and basic courses according to their interests and abilities. At the end of the final grade, students must take and pass qualification exams (*Abiturprüfung*).

Usually, the *Gymnasium* is designed for students who intend to study at a university or college, or who wish to take part in a dual study program (studying at a university/college combined with practical work within a company). Compared to other school types, greater personal initiative, motivation and overall performance is expected at the *Gymnasium*, e.g., studying a second foreign language is required.

As an exceptional rule, it is possible to graduate from *Gymnasium* with a certificate of lower secondary school leaving qualification (comparable to *Hauptschule*) after grade 9, with a leaving certificate of intermediate level secondary school (comparable to *Fachoberschulreife*) after grade 10 or receive the theoretical part of a school-leaving qualification from technical secondary school (*Fachhochschulreife*) after grade 11 or 12 (depending on the state). However, these options are rarely used by students.

Comprehensive Secondary School (*Gesamtschule*)

A fourth option after *Grundschule* is a comprehensive school (*Gesamtschule*, *Gemeinschaftsschule*), which is only found in some federal states. Students of all ability levels are enrolled and assigned to basic or advanced courses depending on their performance level. They can achieve the certificate of lower secondary school leaving qualification (comparable to *Hauptschule*) after grade 9 or 10, the leaving certificate of intermediate level secondary school (*Fachoberschulreife*) after grade 10 or at some schools also the upper secondary school leaving certificate (*Abitur*) after grade 12 or 13.

Other School Types

Students with special educational needs (e.g., physically and/or mentally disabled students) may attend schools for children with special needs (*Förderschule*) which is staffed with specially trained teachers.

Waldorf schools educate students of all ability levels together and implement a pedagogy of encouragement and support that is different from regular schools. Nevertheless, students can achieve ordinary leaving certificates by external examination.

Although the majority of schools in Germany are public schools, there are some private schools as well. These schools usually charge tuition and may offer varied courses leading to ordinary leaving certificates, mostly the upper secondary school leaving certificate (*Abitur*). Some private schools are boarding schools (*Internat*) as well.

Data Collection and Encoding System

Data Collection

Within the report card data collection, the twins (ptyp 1, t and ptyp 2, u) as well as the participating siblings (ptyp 200, s) were in general considered as target respondents. In the following of this report, these target respondents are subsumed under the designation “children”. All variables concerning the report cards belong to the certificate module of the TwinLife questionnaire and hold the variable stem ‘cer’ as an abbreviation of ‘certificate’. They contain basic information (e.g., school type, school year, grade) as well as more detailed information (e.g., grades in specific subjects). In general, information on these variables and their frequencies can be found in the TwinLife Codebook (<https://www.twin-life.de/documentation/downloads>) and also on the data documentation webpage <https://paneldata.org/twinlife/>.

Predominantly, the report card data was collected during the *Face-to-Face* (F2F) interviews by taking photos of the most recent annual report cards of the children and, if available, the school-leaving certificate of the highest qualification obtained so far. Afterwards, the corresponding information was transferred into a more generalized report card-scheme. Overall, the report card photo data can be found in variables cer2000 to cer3002. Participant consent for persons aged 18 years or older is presented in variable cer1001. Parental consent for the report card photos for children younger than 18 years can be found in the variables cer1001t (for twin 1), cer1001u (for twin 2), and cer1001s (for participating siblings) in datasets of F2F 2 (wid = 3) and F2F 3 (wid = 5). Variable cer1002 was generated from the variables cer1001 and cer1001[t,u,s] at the person level (ptyp = 1, 2, 200) and indicates whether there was consent to photograph the report card of twins and siblings. Information on actual school attendance at F2F 1 is given in variable cer1000 (1 = enrolled in school; 2 = not enrolled in school anymore; 3 = not enrolled in school yet – no report card).

If the actual report card was not available or if there was no consent that the report card may be photographed, an alternative questionnaire was used. Hereby, the participants were asked questions about their academic performances with regard to their most recent report card (e.g., school type; grades in German and mathematics and type of school leaving certificate, if existent). In case, they were aged 18 years and above, the target persons themselves were interviewed. The corresponding information on these self-reports can be found in variables cer1100 to cer1700. By contrast, if the children were younger than 18 years old, their parents were asked questions in this respect. The corresponding information on the parental reports,

collected from F2F 2 onwards, can be found in variables cer1004[t,u,s] to cer1013[t,u,s]. In order to identify if the parental report refers to twin 1, twin 2, or a sibling, the indices *t*, *u* or *s* are added after each variable stem, respectively. Hence, except for rare cases, there is only not both a self-report or an informant report for every person, but not both. Please note, that parental reports identified by added *t*, *u* and *s* indices after each variable stem always pertain to parent person types or partners of the parents (ptyp = 300, 400, 500, 600). The alternative questionnaire collected within the F2F 1 survey only relies on the children's self-reports, as the corresponding age filter was newly implemented in subsequent surveys.

In this respect, the general information on children's participation in the report card module and the respective survey methodology (report card photo vs. alternative questionnaire) can be found in variable cer0001 which is encoded as presented in Table 1. Moreover, the respective number of cases by person type is listed there. To disclose if the report card data refers to a current certificate or to an older one which was only recorded in a following wave, please consult variable cer2000 as this variable contains the date of issue of the photo data. In case the report card data was gathered using the alternative questionnaire, please consult variable cer1006[t,u,s] or cer1600 (school class of last report card) and cer1300 (year of graduation certificate).

Additionally, some annual report card data was collected within the first conducted *Computer Assisted Telephone Interviews* (CATI 1). Thereby, few questions about academic performances, such as those of the alternative questionnaire, were asked. The corresponding information can be found in variables cer0100 to cer0305. For data collected within the CATI 1 survey, the children were surveyed themselves if they were aged 15 years and older. If they were aged younger than 15 years, the parents were interviewed on these questions. In cases where parents provided information about their children, the indices *t*, *u* or *s* are added after each variable stem to indicate if the information refers to twin 1, twin 2 or a sibling, respectively.

Please note, it is possible that subjective reports from children or parents yield specific methodological effects. These might arise, for instance, due to recall biases or self-enhancement strategies, leading to over-reporting of own performances (e.g., Kuncel et al., 2005). However, self-reported grades are deemed an accurate alternative and the respective utilization depends on the research question (e.g., Sticca et al., 2017).

Table 1

Encodings and Frequencies of the Applied Survey Methodology of the Report Card Data (Variable cer0001) by Person Type

Encoding	Frequencies								
	F2F 1			F2F 2			F2F 3		
	T1	T2	S	T1	T2	S	T1	T2	S
1: Report card photo available	1745	1704	721	972	989	477	980	964	361
2: Alternative questionnaire available	1157	1184	722	359	356	214	299	292	184
3: Report card photo and alternative questionnaire available	8	8	0	0	0	0	2	0	0

Note. T1 = ptyp 1, first born twin; T2 = ptyp 2, second born twin; S = ptyp 200, sibling. Please note, within F2F 2 few report card data from the alternative questionnaire is also available for mothers (ptyp 300; $n = 245$), fathers (ptyp 400; $n = 226$) and respective partners of mothers (ptyp 500, $n = 13$) or fathers (ptyp 600, $n = 3$).

Encoding System

Principally, the alternative questionnaire comprises less information than those that can be obtained from the report card photo. Appendix A provides an overview on those variables available from alternative questionnaires or the questions used within the CATI 1-surveys. Furthermore, the equivalent variables regarding these data compared to the report card photo are depicted. Thus, as the most comprehensive information can be taken from the report card photo data, the following detailed descriptions primarily refer to the photo data variables.

The introductory descriptions of the different school types emphasize the complexity of the German school system. In addition, they help to retrace the encoding of the school types in numerical values within the documentation of the report cards. Table 2 displays the school types and the corresponding numbers in the encoding system, which can be found in variable cer2003g. Notably, the respective school type each child attends or attended should be considered when working with the corresponding report card data, as different school types might affect comparability between the grades. For example, the same grade indicates differences in the performance level across the various types of school.

Moreover, the date of issue (cer2000), the semester (cer2001; 1 = semester in autumn; 2 = semester in spring) of the report card, and the current grade level (cer2002) are documented within the encoding system. Beside the values 1 to 13 for the respective grade levels, three values were added to differentiate the grades in senior years of *Gymnasium* or *Gesamtschule*, see Table 3.

Table 2

Encoding of School Types

	German	English translation
1	Grundschule	primary school
2	Orientierungsschule	orientation level for secondary education
3	Hauptschule	lower secondary school
4	Realschule	intermediate level secondary school
5	Verbundene Haupt- und Realschule	integrated lower and intermediate level secondary school
6	Gesamtschule	comprehensive secondary school
7	Waldorfschule	Waldorf school
8	Gymnasium (auch Kolleg)	higher secondary school
9	Sonderschule/Förderschule	school for children with special needs
10	Mittelschule	middle school
11	Fachoberschule	technical secondary school
12	Berufsschule	vocational school
13	Berufsfachschule	vocational college
14	Sonstiges/Other	other

Note. The respective English translations refer to the labels assigned to school types in variable cer2003g.

Table 3*Senior Grades in Gymnasium and Gesamtschule*

	German	English translation
20	Einführungsphase der Oberstufe	introductory phase
21	1. Jahr der Qualifikationsstufe	first senior year
22	2. Jahr der Qualifikationsstufe	second senior year

If the school report includes a graduation certificate, variable 2100 is coded with value 1 (1 = yes, it is a graduation certificate, 2 = no graduation), the school type of graduation (cer2101) is also encoded and information if the report card is the final report card is provided in variable cer2100 (1 = yes, 2 = no). Furthermore, the average grade can be found in variable cer2103 in case it is a graduation certificate. Table 4 contains the different leaving certificates and the corresponding coding numbers.

Table 4*Encoding of Leaving Certificates*

	German	English translation
1	Schule ohne Abschluss verlassen	left school without school-leaving qualification
2	Volks-/Hauptschulabschluss	primary/lower secondary school-leaving qualification
3	Realschulabschluss/Mittlere Reife	intermediate secondary school-leaving qualification
4	Fachhochschulreife (Abschluss einer Fachoberschule)	university of applied sciences entrance diploma (school-leaving qualification from a technical secondary school)
5	Abitur/Hochschulreife	upper secondary school-leaving qualification (Abitur/university entrance diploma)
6	sonstiger Schulabschluss	other school-leaving qualification

Note. The respective English translations refer to the labels assigned to leaving certificates in variable cer2101.

The most common school subjects are listed in the encoding system (cer2000 – cer2233 and cer2300 – cer2303; see Appendix B). Each subject in the school report and the received grade is entered into the encoding system. If necessary, the grades of up to four additional

subjects that are not included in the previous list are entered as “Further subject grade” / “*Weiteres Fach Note*” (cer2235 – cer2241). The remaining subjects are counted and their number is listed (cer3000). Finally, in variable cer3002, it is specified whether the assessment of the students’ performance took place in the form of grades (= 1), written assessment (= 2) or a categorial assessment (= 3).

Regarding the so called “*Kopfnoten*”, evaluating student’s social behavior, participation in class and motivation, the recoding of assessments was improved from data release v4-1-0 onwards, to facilitate comparability. The individual assessments are now combined into two broader domains to ensure data protection since some of the individual assessments have small numbers of valid cases, as specific assessments might only be available in some states. The domain “willingness to learn” combines assessments on motivation, diligence, independence and effort, while the domain “social behavior” includes assessments on conflict management, ability to cooperate, and taking on responsibility. The dataset includes variables for both domains, first, in the form of numeric grades (cer2300 and cer2302; ranging from 1 = very good to 4 = not satisfactory) and, second, in the form of categorical ratings based on the corresponding written statements (cer2301 and cer2303; 1 = positive assessment, 2 = average assessment, 3 = negative assessment). In addition, the two types of assessment are treated separately because numeric grades taken directly from the report cards provide a more objective evaluation than the ratings of written statements. In data releases previous to v5-0-0, both types of assessments were combined into one variable.

Further Variables on Educational Attainment

Information on school-leaving qualifications of the participating children can also be found within the variables with the stem ‘eca’. At first glance, it might seem as if there were some redundancies, especially regarding the graduation certificates in case the respondents participated in both survey modules. However, both variables refer to different aspects. Especially, the ‘eca’-variables refer to the last or highest completed graduation or the school-leaving qualification. Therefore, a target person might hold a graduation from intermediate level secondary school, with the respective information contained within the ‘eca’-variables, but they might also further attend upper secondary school and thus, information on a more recent report card is included within the ‘cer’-variables. Please note, for children still attending school, the actual highest school-leaving qualification is still pending and data from the ‘cer’-variables might indicate the current educational performance of the respective child. Moreover, information on the current vocational training or school attendance can be found in the ‘edu’-

variables. In case the survey took place during the summer vacation, information on the current grade level (edu0402) refers to the grade level applicable after the vacation. Compared to the report card data, these variables predominantly refer to the educational activity pursued at the date of the survey, whereas the report card data refers to the most recent certificate received.

Handling of Missing Data

There are different reasons for missing data, for example if the photo taken is out of focus, the second page of the school report is not available or the student received no grades because of an illness. In these cases, the school report is encoded nonetheless and missing values are used to specify the reason why data is missing. In some primary school report cards, the missing value -95 is also used if the student received a written feedback without any grades. Table 4 lists the utilized missing values for the report card data and the assigned numerical values. The respective counts of the specific missing types and further possible types of missing values can be found in the TwinLife Dataset (Diewald et al., 2022) with the corresponding TwinLife Codebook (ZA6701_cod_wid5.pdf).

Table 5

Missing Values

-86	Subject not on certificate
-88	Subject legible but grade illegible
-89	Illegible
-90	No participation in survey wave
-92	No participation in survey module
-93	Unclear classification of system missing
-94	Technical error / faulty insertion
-95	Doesn't apply / screened out

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Appendix

Appendix A

Equivalent Variables of Report Card Data Across the Different Survey Methodologies

Variable	Photo	Alternative Questionnaire SR	Alternative Questionnaire PR	CATI 1 SR	CATI 1 PR
Math grade	cer2200	cer1400	cer1004[t,u,s]	cer0100	cer0100[t,u,s]
German grade	cer2201	cer1500	cer1005[t,u,s]	cer0200	cer0200[t,u,s]
Grade level / School Class	cer2002	cer1600	cer1006[t,u,s]	cer0305	cer0305[t,u,s]
Type of school	cer2003g	cer1700	cer1007[t,u,s]	cer0303	cer0303[t,u,s]
Annual or final report card	cer2100	-	cer1013[t,u,s]	-	-
Average grade of highest school- leaving certificate	cer2103	cer1100	-	-	-
Type of school leaving certificate	cer2101	cer1200 (cer9000)	-	-	-
Year of graduation / Year of highest school degree	-	cer1300	-	-	-
Year of last annual certificate	cer2000	-	-	cer0301	cer0301[t,u,s]
School half-year of certificate	cer2001	-	-	-	-

Note. SR = Self-report, PR = parental report. In case, the variable was gathered using parental reports, the indices *t*, *u* or *s* are added to the variable name after the variable stem, referring to twin 1 [t], twin 2 [u], or a sibling [s]. Variables containing parental reports are available in CATI 1 (wid = 2), F2F 2 (wid = 3), and F2F 3 (wid = 5) datasets, but not in F2F 1 (wid = 1) and CATI 2 (wid = 4) dataset. Each listed variable refers to the most recent available report card of the target respondent. Please note, variable cer1200 is not available in F2F 1 (wid = 1) dataset, instead the alternative information can be found in variable cer9000.

Appendix B

Variable Names and English Translations of School Subjects in the Report Card Photo Data

Variable	Subject in German	Subject in English
cer2200	Mathematik	Mathematics
cer2201	Deutsch	German
cer2202	Sprachgebrauch	Language usage
cer2203	Sprachgebrauch mündlich	Language usage (oral)
cer2204	Sprachgebrauch schriftlich	Language usage (written)
cer2205	Lesen	Reading
cer2206	Schrift	Writing
cer2207	Rechtschreibung	Orthography
cer2208	Englisch	English
cer2209	Weitere Fremdsprache (Sprache)	Further foreign language (language)
cer2210	Weitere Fremdsprache (Note)	Further foreign language (grade)
cer2211	Chemie	Chemistry
cer2212	Physik	Physics
cer2213	Biologie	Biology
cer2214	Informatik	Computer science
cer2215	Naturwissenschaften	Science
cer2216	Sachunterricht/ Heimat- und Sachkunde	Regional history and geography
cer2217	Sozialwissenschaften/Gesellschaftslehre	Social sciences
cer2218	Geschichte	History
cer2219	Erdkunde	Geography
cer2220	Politik	Political science
cer2221	Politik/Wirtschaft	Politics/economics
cer2222	Religionslehre	Religion
cer2223	Ethik	Ethics
cer2224	Philosophie	Philosophy
cer2225	Kunst	Art
cer2226	Musik	Music
cer2227	Textilgestaltung	Textile design
cer2228	Arbeitslehre	Business and employment studies

cer2229	Technik	Technics
cer2230	Werken	Carpentry and handicrafts
cer2231	Hauswirtschaft	Home economics
cer2232	Wirtschaft/Volkswirtschaft	Economics
cer2233	Sport	Physical Education
cer2300	Kopfnote – Mitarbeit (Note)	Behavioral grade – participation (grade)
cer2301	Kopfnote – Mitarbeit (schriftl. Bewertung)	Behavioral grade – participation (written assessment)
cer2302	Kopfnote – Sozialverhalten (Note)	Behavioral grade – social behavior (grade)
cer2303	Kopfnote – Sozialverhalten (schriftl. Bewertung)	Behavioral grade - social behavior (written assessment)
