



# Upper Secondary Education in Academic School Tracks and the Transition from School to Postsecondary Education and the Job Market

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## Abstract

In Stage 5 of the German National Educational Panel Study (NEPS), we are focusing on upper secondary education in academic school tracks and the subsequent transitions. We give an overview of prior empirical studies of the upper secondary level and describe a number of unresolved general research questions that are being focused on in Stage 5. These questions mainly address the comparison of traditional and non-traditional pathways to the *Abitur* (the general qualification for university entrance),

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the academic achievement levels of *Abitur* students (in different school types), social disparities (in traditional and nontraditional *Gymnasium*), and how well achievement indicators (school grades, competencies, *Abitur* certificate) predict students' further development. Although the NEPS research instrument is very broad, these guiding questions are central for its development. In addition to the panel study, Stage 5 is implementing two supplementary studies to reflect changes due to reforms of the *Gymnasium* and their consequences for the interpretation of NEPS longitudinal data. One study focuses on the organizational reform in Thuringia; the other on the reduction in the number of years of schooling for the *Abitur* (G8 reform) in Baden-Wuerttemberg. Both studies are described in some detail. The chapter closes with a short summary of the valuable contributions of NEPS in Stage 5.

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**Keywords**

Education · General qualification for university entrance · Panel study  
School reform · Upper secondary education

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## 14.1 Introduction

In Germany, students must acquire specific school-leaving certificates if they are to enter postsecondary education at the college/university level (“higher education”). This access to higher education has been broadened over the last decades, with several alternative routes leading to the necessary certificates. However, the highest and most attractive school-leaving certificate is still the *Abitur* that provides access to the greatest range of higher education. In fact, the *Abitur* occupies the central role, and 80% of freshmen in Germany possess this qualification (winter semester 2011/12; at universities, this is even 96%—Scheller et al. 2013). The majority of young adults acquire their *Abitur* at the upper secondary level of a *Gymnasium*. Consequently, the main focus of this chapter is on this institution.

The organization of the upper secondary academic track education, the curriculum to be implemented, and the characteristics of the upper secondary school-leaving certificate, the *Abitur*, have always played a major role in scientific, political, and public discussions about the school system. Because it opens up access to a highly attractive range of careers for a selected group of students, the upper secondary academic track education and the *Abitur* have been the subject of several long-standing political and scientific debates (Baumert et al. 2003; Huber 2004; Köller et al. 2004; Trautwein et al. 2007, 2010a; Trautwein and Neumann 2008). To name but three questions in these debates: What role does social background play in predicting who will acquire the *Abitur* and in *Abitur* students’ decisions for or against attending university? Are the subject- and competency-related standards appropriate (in view of the quality of preuniversity education)? How predictive are achievement levels at the *Abitur* for later success at university and in the job market? Before the National Educational Panel Study (NEPS), there had been no systematic nationwide empirical monitoring and evaluation of the upper secondary level that would give scientifically sound answers to these and other questions.

The German *Gymnasium* recently underwent two important transformations (see Trautwein and Neumann 2008). First, many states have reformed the curriculum and organization of upper secondary schooling with the aim of increasing the common knowledge basis for all students. The reforms have brought a substantial reduction of choice options (e.g., advanced course choices) with the aim of homogenizing the curriculum experienced by all students. Second, in recent years, most German states have implemented an 8-year (G8) in place of the 9-year (G9) *Gymnasium* system. Therefore, students who do not repeat any years will graduate with *Abitur* after 12 rather than 13 years. Such reforms may cause cohort effects in outcomes and students’ educational biographies and are thus highly relevant for NEPS. However, it should be mentioned that several states have now revoked or eased this reform (see Hübner et al. 2017).

In the present chapter, we give an overview of the work in so-called Stage 5 of NEPS and its linkage to the NEPS pillars and the adjacent stages (for the framing concept of NEPS see Chap. 1, this volume). We begin in Sect. 14.2 with an overview of empirical

studies on the upper secondary level that were already available before NEPS started. This shows that there was a clear need for a project such as NEPS. In Sect. 14.3, we then describe a number of unresolved general research questions revolving around the upper secondary level. Although the research instruments developed for NEPS are very broad, these guiding questions translate into elements of their implementation. The major elements of the research instruments are described in some more detail in Sect. 14.4. Over the last couple of years, there have been major changes in academic track education in many German states, and Sect. 14.5 describes how these changes and their consequences for the interpretation of NEPS data are reflected in the NEPS data collections.

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## 14.2 Systematic Empirical Studies of Upper Secondary Education

Before NEPS started, there had been several empirical studies focusing on or including upper secondary education in Germany over the last decades, some of which have been quite influential in terms of their scientific or policy impact. The description of the studies will highlight some of their accomplishments. However, all these studies suffer from at least one of three major shortcomings, highlighting the methodological strength of NEPS. First, some studies are cross-sectional only—they do not cover the path into upper secondary education and the transition to higher education or the job market. Second, some large-scale studies focus on only one German state or on a restricted number of states. Third, several studies do not include standardized achievement measures. In the following, we shall give a short description of some of the studies that have had some impact on the discourse about upper secondary education.

Designed as a household panel study, the German Socio-Economic Panel Study (SOEP) provides an important database for educational research (Lohmann et al. 2009; Lohmann and Witzke 2011; Schupp 2009). Starting in 1984 with a sample at the household level, each member of the household as well as their offspring should be followed for as long as possible (Wagner et al. 2007). For research on educational participation and transitions in educational biographies, for instance, such data are highly valuable. Unfortunately, the SOEP does not provide standardized achievement measures (since 2006, however, general cognitive ability is being assessed by standardized tests; see Schupp et al. 2008).

The German Life History Study<sup>1</sup> (GLHS; *Lebensverläufe und gesellschaftlicher Wandel*) conducted by Karl Ulrich Mayer, started in 1979 with funding from the German Research Foundation (DFG; *Deutsche Forschungsgemeinschaft*), and has been continued at the Max Planck Institute of Human Development and Education in Berlin and the

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<sup>1</sup>Documentation of the different substudies is available under <https://www.mpib-berlin.mpg.de/de/forschung/beendete-bereiche/bildung-arbeit-und-gesellschaftliche-entwicklung/publikationen> [Retrieved April 3, 2018].

Center for Research on Inequalities and the Life Course (CIQLE) at Yale University. The following cohorts were assessed in western Germany (including West Berlin): 1919–1921, 1929–1931, 1939–1941, 1949–1951, 1954–1956, 1959–1961, 1964, and 1971. The eastern German cohorts include 1929–1931, 1939–1941, 1951–1953, 1959–1961, and 1971 (Hillmert et al. 2004; Solga 1996; Wagner 1996). The major focus of the GHLS is on investigating social conditions before, during, and after German reunification, and it provides retrospective life-course information on, for instance, the family of origin, residential history, education, and work life. Because there have been several changes in the German educational system since the last birth cohorts of this study left school, more recent data are needed. The study also lacks academic achievement measures, and few instruments permit examinations of psychological characteristics associated with different educational biographies.

With the international comparison based on data from a total of 24 participating countries, the large-scale, representative Third International Mathematics and Science Study, Population III (TIMSS/III; Baumert et al. 2000) has been very influential. Three different competence areas were assessed (although some countries did not participate in all areas): mathematics and science literacy (22 countries), advanced mathematics (17 countries), and physics (18 countries). The international comparison showed that German students attained only average results in mathematics and science literacy despite their rather high mean age (19.5 years) compared to final school year students from other countries. With regard to college-preparatory education—the academic track—German students' mathematics as well as physics achievement lay in the average range of international results. TIMSS can be seen as the starting point for increasing interest in the use of standardized achievement tests to monitor the effectiveness of a school system. Unfortunately, no longitudinal component was included in this study.

Two longitudinal studies have been conducted in Hamburg (LAU; *Aspekte der Lernausgangslage und der Lernentwicklung*; see Lehmann et al. 2006; Trautwein et al. 2007 and KESS; *Kompetenzen und Einstellungen von Schülerinnen und Schülern*; see Scharenberg 2012; Vieluf et al. 2014). These studies were unique in that they tracked students from the first year of lower secondary education up to their last year of upper secondary education. Using standardized achievement tests in several school subjects, they provided unprecedented insights into individual development and the trajectories of achievement in different school types. For instance, with regard to the upper secondary level, there were large differences between different school types: Students in *Gesamtschule*, *Aufbaugymnasium* (a special school type leading to Abitur for students from *Realschule*), and *Wirtschaftsgymnasium* (upper secondary vocational school of economics) scored considerably lower on the mathematical literacy and advanced mathematics tests compared to students in the traditional *Gymnasium* and the *Technisches Gymnasium* (*Gymnasium* with a technical focus). Further, a comparison of *Gymnasium* students from the LAU and KESS cohorts with G9 (LAU) and G8 (KESS) educational tracks showed statistically significant differences regarding competencies partly in favor of the G8 students, and partly in favor of the G9 students (Ivanov et al. 2016). It should

be noted, however, that due to the time lag of 7 years between both cohorts (and other organizational reforms besides the G8 reform implemented within this time period), the background characteristics of *Gymnasium* students in both studies were quite different. Moreover, both studies collected only a limited set of variables shedding light on characteristics of the students and their families that might help to explain the variability in educational biographies. Furthermore, studies were restricted to Hamburg alone.

The longitudinal Learning Processes, Educational Careers, and Psychosocial Development in Adolescence and Young Adulthood Study (BIJU; *Bildungsverläufe und psychosoziale Entwicklung im Jugendalter*) traced students' development from Grade 7 up to the transition to either higher or vocational education. Data from students in two eastern German states, one western German state, and Berlin (East and West) were collected at the start of the unification of the East and West German school systems in which the East German school system was largely transformed into the existing West German system. BIJU yielded several important findings. For instance, it showed that the school achievement of students with identical school-leaving certificates differed greatly depending on the state they lived in and the school type attended. Furthermore, research based on the BIJU dataset documented how the composition of the learning environment has a lasting impact on psychosocial outcomes (e.g., Marsh et al. 2007), found a positive impact of attending the academic track on psychometric intelligence (Becker et al. 2012), showed the reciprocal association between achievement and self-related cognitions (e.g., Trautwein et al. 2006a), and documented that gender effects on course selections in upper secondary education (biology and mathematics in Grade 12) can be explained fully by differences in achievement, self-concept, and intrinsic value (see Nagy et al. 2006). However, a central limitation of BIJU is the restriction to only four German states.

The multicohort longitudinal Transformation of the Secondary School System and Academic Careers Study (TOSCA; Köller et al. 2004; Trautwein et al. 2007) is currently one of the largest research projects focusing on the transition to higher education and the job market. Several thousand Grade 10 and *Abitur* students in the state of Baden-Wuerttemberg participated in school achievement tests and answered a student questionnaire focusing on their school biography, their family background, various psychological characteristics, and their plans for the future. The central limitation of the TOSCA dataset is its restriction to Baden-Wuerttemberg, a state whose school system and higher education system differ in several respects from those of other states.

The *Studienberechtigte* study (*Hochschul-Informationssystem*; HIS) started in 1976. In the 2004/2005 school year, it was supplemented for the first time by an additional assessment half a year *before* students reached their qualification for higher education (university of applied sciences, university) (Heine et al. 2005; Heine and Willich 2006). The second assessment following the usual practice in the *Studienberechtigte* study took place half a year *after* students left school. A central aim of the study is to validate the prognostic potential of students' intentions to enroll at a university or a university of applied sciences (for results based on the panel in 2015, see Mentges and Renneberg

2018). Results based on the panel starting in 2010 (Spangenberg and Quast 2016) showed that 70% of the students started or seriously intended to start higher education studies at a university or a university of applied sciences; 12% were unsure whether to study or not. In a third assessment 4.5 years after leaving school, the percentage of students who were enrolled in academic education increased to 80%. The limitations to this dataset include the omission of standardized achievement tests.

In summary, each of the existing studies suffers from at least one major limitation (cross-sectional nature, omission of standardized achievement tests, limited scope in terms of regional outreach). Because of the restricted data situation, many questions of major educational and political interest cannot be answered. Consequently, NEPS has the potential to provide a more comprehensive as well as a more detailed picture of educational careers in Germany than the studies mentioned above.

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### 14.3 Key Research Areas

There are many unresolved general research questions revolving around the upper secondary level and its linkages to other NEPS stages. The empirical work with the NEPS dataset has generated many research questions and answers that did not cross the minds of those responsible for designing the study right from the outset. Nonetheless, the research instrument developed for NEPS is purposefully quite broad and designed to accommodate questions that were not evident when the design and the variables were determined. Despite this breadth, several key questions guided the development of the final instrument. We describe four of these guiding questions in more detail.

#### 14.3.1 Traditional and Nontraditional Pathways to the *Abitur*

The majority of students still receive their *Abitur* certificate from traditional *Gymnasium* schools. In recent decades, however, many German states have introduced alternative institutional structures that lead to higher education including *Gesamtschulen* and vocational *Gymnasien*. These long-lasting developments have led to a rather dyadic secondary school system in most German states nowadays, and alternative school types have become established as important institutions in which many students can receive *Abitur* certificates (Maaz et al. 2013; Neumann et al. 2013; Neumann et al. 2017; Tillmann 2012, 2016). The data collected in NEPS (see the contributions of the pillars and Stage 4, Chaps. 4, 5, 6, 7, 8, 9 and 13, this volume) can help to improve our understanding of the interplay of different factors predicting these pathways.

With respect to achievement differences (see also Pillar 1, Chap. 4, this volume), the small body of existing data seems to imply differences in students' academic achievement between traditional and nontraditional *Gymnasium* (Trautwein et al. 2007). These



differences seem to reflect the different school careers of the students on traditional and nontraditional pathways to *Abitur* before Secondary Level II (Köller et al. 1999).

In terms of social disparities (see also Pillar 3, Chap. 6, this volume), it is still unclear whether opening up new paths to higher education results in increased or decreased social disparities. Based on data from the TOSCA project, Watermann and Maaz (2006) found a considerably lower socioeconomic background for vocational versus traditional *Gymnasium* students. This may indicate a positive effect of the nontraditional pathways to higher education. In a comparative study with data from 13 countries (including Germany), Blossfeld and Shavit (1993) found the effect of social selectivity to be highest at the first transition from elementary school, and that it then declined for later transitions (except in Switzerland). This result was also confirmed by a (West) German longitudinal study (Education, Training, and Occupation: Life Courses of the 1964 and 1971 Birth Cohorts in West Germany; Hillmert et al. 2004) drawing on data from the 1964 birth cohort until age 40 (Hillmert and Jacob 2010). However, Hillmert and Jacob (2005, 2010) also found that the relative advantage of students with a higher educational background increased at each stage in their educational careers. Additionally, the study showed the importance of a longitudinal perspective on the process of educational attainment: Besides the ideal-typical sequence of academic track transitions (elementary school—[traditional] *Gymnasium*—*Abitur*—higher education—attainment of a university degree), there are also many alternative pathways (e.g., second chance education, later entry or reentry to university).

There is strong evidence showing that students with a migration background (see also Pillar 4, Chap. 7, this volume) are underrepresented in preuniversity tracks (e.g., Avenarius et al. 2003). However, this relative disadvantage seems to vary across different states (e.g., Trautwein et al. 2007). Moreover, there may be differences in the achievement levels of students with and without a migration background, and the decisions regarding further education (e.g., attending university vs. starting an apprenticeship) might be associated with migration status.

Gaining adequate answers to research questions concerning traditional and nontraditional pathways to the *Abitur* requires a complex study design. The major limitation of present studies is their lack of a “complete picture.” NEPS is designed to reduce these limitations. Central research questions concerning the different pathways to the *Abitur* include:

- Are the levels of academic achievement comparable across different school types with academic tracks in the *gymnasiale Oberstufe*?
- Are the nontraditional pathways to *Abitur* attractive alternatives to the traditional *Gymnasium*—in particular, for students from less favorable social backgrounds or with migration backgrounds? Do they decrease social disparities or even increase them?



### 14.3.2 Which Competencies Do *Abitur* Students Possess?

The competencies of students at the end of their school careers have been a cause of concern for many years (e.g., Deidesheimer Kreis 1997; Heine et al. 2008; Heublein et al. 2003). Are they well-prepared for higher education? Do they possess the necessary cognitive and noncognitive competencies to enter an apprenticeship? How important are formal and nonformal/informal learning environments for the development of the different competencies?

In the context of NEPS, the conceptualization described in Pillar 1 (see Chap. 4, this volume) is being implemented at the upper secondary education level. Thus, a broad conceptualization of competencies is being used that is based mainly on four clusters (domain-general cognitive functions, domain-specific cognitive competencies, metacompetencies/personality, and stage-specific competencies). The systematic assessment of core competencies helps close evident research gaps and provide important data for an efficient monitoring of the German school system. Possible research questions include:

- How strong are differences in the achievement levels across different pathways to the *Abitur*?
- Have students acquired the skills and strategies they will need at university, the readiness to adopt a science-oriented approach in everyday life, and an understanding of the limits of human understanding (Huber 1997)?
- What is the personality profile of successful *Abitur* students?

### 14.3.3 Social Disparities at the Transition to Higher Education

Specific emphasis should be placed on the association between family background and the options taken up at the post-*Abitur* transition. There is consensus in educational and social structure research that social inequality in educational participation emerges primarily at points of transition in the education system (Breen and Goldthorpe 1997; Schnabel et al. 2002). These transitions reflect the cumulative effects of previous educational decisions: the earlier educational choices have to be made, the more sustained the effects of social disparities (Shavit and Blossfeld 1993); the later in the educational career these decisions are made, the weaker the effects of social disparities (Mayer et al. 2007). Social disparities in access to higher education can be expected to be smaller, but they may still be of meaningful size (Hillmert and Jacob 2010). Also, with the educational expansion in the last decades, the odds ratio for students of less privileged backgrounds to achieve the *Abitur* has improved, whereas the inequality at the transition to higher education has increased (Lörz and Schindler 2011).

The effect of secondary social disparities at university entrance has been studied by examining the university aspirations of students with *Abitur* as well as the transition to higher education. Based on BIJU data, Schnabel et al. (2002) showed that the intention to

enter university increases 1.5-fold when one parent holds the *Abitur* rather than a lower school certificate. Similarly, analyses with the TIMSS data (Schnabel and Gruehn 2000) showed that parents' highest educational qualification had a positive effect on university intentions after controlling for students' school performance. However, the effect of the educational milieu at home clearly decreased after controlling for the perception of parents' university expectations. This shows that the university aspirations of young adults develop in the context of their parents' expectations, and that these differ according to the social status of the family. Using the TOSCA dataset, Maaz (2006) showed that social class had only a small effect on participation in higher education (see also Watermann and Maaz 2006). However, there were differences in the type of university selected by students from different family backgrounds. Students with *Abitur* from a privileged family background were more likely than their peers with less favorable backgrounds to select university (rather than a university of applied sciences, college of education, or vocational academy; Maaz 2006; Trautwein et al. 2006b; Watermann and Maaz 2004).

A number of studies have examined social disparities at the transition to higher education based on datasets of the *Studienberechtigte* study (*Hochschul-Informationssystem*; HIS) (e.g., Lörz 2012, 2013; Neugebauer et al. 2013; Reimer and Pollak 2010; Schindler and Reimer 2010, 2011). Schindler and Reimer (2010) quantified the relative strength of primary and secondary effects at the transition to tertiary education. Based on an effect decomposition proposed by Erikson and colleagues (2005), they showed that more than 80% of the disparities in the transition rates between students from working class and service class can be traced back to secondary effects (see also Neugebauer et al. 2013; see, for an overview, Watermann et al. 2014).

Watermann and Maaz (2010) examined which mechanisms mediate the association between social background and the decision to enter higher education. As a decision model, they adapted Ajzen's theory of planned behavior to the transition to higher education. Based on this theory, (a) attitudes to higher education, (b) the perceived expectations of the social background with respect to higher education, and (c) perceived behavioral control in terms of students' confidence in their ability to enter and succeed in higher education can be considered to be the key determinants of intention to study. Drawing on data from a subsample of participants in the TOSCA study, a decision model was specified for the analysis of secondary background effects, and the transition to higher education was analyzed from a longitudinal perspective. Thereby, the effects of social background were found to be mediated by the indicators of the decision model.

Based on the rational choice framework of Erikson and Jonsson (1996), Schindler and Reimer (2010) modeled secondary effects of social background at the transition to higher education in terms of perceived costs, returns, and success probability. Using the nonlinear effect decomposition proposed by Fairlie (2005), they quantified the extent to which grade of *Abitur* (primary effect) and motives of postsecondary career path (secondary effect) can explain the transition gap between students from service classes and students with a working class background. The perceived costs, operationalized via the relevance of financial independence, proved to be the item with the most explanatory power.

Questions pertaining to social disparities in access to higher education have always been of interest in social research, and they gain additional relevance in the current context of reform in the tertiary sector. For instance, relevant research questions include:

- How large are social disparities in access to higher education?
- Do these disparities differ for the different types of higher education?

#### **14.3.4 Achievement, School Grades, and Certificates: Predicting Further Development?**

Of course, one highly relevant research field to which NEPS is adding knowledge is the issue of long-term returns to education (see Pillar 5, Chap. 8, this volume). In this chapter, we shall focus on only one small subaspect: the relative predictive power of various indicators of achievement.

Prior research has documented that school achievement collected via standardized achievement tests correlates only rather moderately with teacher-assigned school grades or cognitive ability (Baumert et al. 2003; Volodina and Nagy 2016). This—and the increasing role of the university in the admission of students to highly valued study subjects—opens up a multitude of important research questions. A good final school grade gives students access to highly valued fields of study in which slots are assigned—at least in part—on the basis of the *Abitur* grade. When predicting a successful transition to vocational training or university (see Stages 6 and 7, Chaps. 15 and 16, this volume), NEPS is able to examine the role of school type attended, type of school-leaving certificate acquired, basic cognitive abilities, school achievement in the standardized school achievement tests, and teacher-assigned school grades. Which indicator is of special importance for a successful transition to university or the labor market (Nagy 2006; Volodina and Nagy 2016)?

Modern educational systems rely on the assumption that competence levels predict future success in higher education and in the vocational field. However, it has also been argued (e.g., Solga 2005) that employers rely heavily on the type of school-leaving certificate as a “signal” (Spence 1973) when taking on apprentices or hiring employees. The same might be true for universities. There is some reason to believe that—due to their easy availability for employers and admission boards—school-leaving certificates and school grades will have a more pronounced effect on students’ success in the application process, whereas, in contrast, competencies and abilities predict success during university, vocational training, or the occupational career. However, as plausible as this reasoning may be, there is a need for studies that empirically separate the confounding effects of certificates and competence levels in the short and long run. Moreover, there is a need to differentiate between various facets of cognitive abilities. Several studies from the United States seem to indicate that general ability plays a more important role for training success than basic competencies or specific abilities (e.g., Ree and Earles 1991).

However, more convincing empirical support for such a pattern of results is largely lacking in the German context. For example, Volodina et al. (2015) found that only general cognitive abilities had a small albeit significant effect on dropout intentions in a sample of apprentices in vocational educational and training.

Another exception is Nagy's (2006) analysis of the TOSCA database. He used a broad set of variables assessed at the end of secondary schooling to predict success at university 2 years later. His analyses showed that grade point average (GPA), cognitive abilities, and school achievement test scores were all related to achievement in university. In the total sample, only GPA and cognitive abilities exerted significant effects, whereas school achievement measures had no incremental predictive power. However, Nagy (2006) also found that math test scores had a stronger predictive power for students entering math-intensive fields of study (e.g., engineering). These findings indicate that an examination of individual factors such as competencies (basic cognitive abilities, achievement, study-related competencies), vocational interest, motivation, and long-term plans should be complemented by the investigation of contextual factors (e.g., specific university types and subjects and type of vocational training).

Hence, some relevant research questions that may be addressed using the NEPS dataset include:

- Which indicators are most important in predicting long-term outcomes?
- To what extent does this prediction model differ when looking at different study fields or jobs?

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## 14.4 Instruments

In line with the longitudinal design of NEPS, the majority of instruments administered to students, parents, and principals are the upper secondary versions of the standard instruments used throughout the school career (for the constructs being used, see the contributions of the pillars and Stage 4, Chaps. 4, 5, 6, 7, 8, 9 and 13, this volume). However, some additions and refinements are necessary to cover specific aspects of upper secondary education in the preuniversity track.

*Wissenschaftspropädeutik.* A specific focus is on study skills and critical and scientific thinking. These are subsumed under the heading *Wissenschaftspropädeutik* in the German educational literature. Self-report measures (see Heine 2002; Trautwein and Lüdtke 2004) as well as “tests” of critical and scientific thinking (e.g., Krettenauer 2005) have been used, but much work is needed to improve and enrich these instruments. We used the pilot testing phase of the NEPS to develop a more comprehensive measure of scientific thinking as metascientific reflection (Oschatz et al. 2018; Rieger et al. in prep).

*English as a Foreign Language.* English is the lingua franca (see Tenorth 2001) of today's scientific world, and, due to ongoing globalization processes, essential in many relevant areas of career and everyday life (e.g., economy, modern communication in the "global village"). Therefore, an additional assessment of English-language skills was realized in Grade 10, Grade 12, and (former) university students.

*Stage-specific questions about educational and vocational choices.* A battery of questions was used that focus on courses taken in upper secondary school, examination subjects in *Abitur*, and the transition to university or vocational training. The instruments used in the TOSCA study (Köller et al. 2004) as well as instruments developed in cooperation with Stages 6 and 7 (see Chaps. 15 and 16, this volume) provide the main source for this questionnaire. Students who changed schools and no longer attend a NEPS school are being tracked individually and assessed via an online module (see Chap. 1).

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### **14.5 Documenting the Effects of the Recent Abitur Reforms: Systematic Assessment of Core Competencies Under Changing Institutional Conditions**

The focus of NEPS is on individual development in the context of institutionalized and noninstitutionalized learning environments. For this reason, NEPS examines how schooling influences the lives of children and adults and how differences in school experiences translate into various outcomes. At the same time, the longitudinal nature of the study is of utmost importance, and not all variations in learning environments can be observed in desirable depths. Importantly, the sample size is not large enough for many possibly interesting analyses. Given the focus on longitudinal analyses, the level of detail with regards to the learning environment has to be somewhat restricted. Clearly, NEPS cannot and will not attempt to replace other studies that yield information on, for instance, either the quality of the educational system, the competence levels of teachers, or document changes in the school system. However, there are a small number of extensions to the longitudinal data base of NEPS that considerably strengthen the longitudinal analyses, including pilot studies and method studies.

At the upper secondary level, the NEPS design includes two additional data collections addressing two major changes in the *Gymnasium* system so that it can gauge the consequences of these reforms for individual educational biographies. These reforms can be viewed as "natural experiments" that provide a fascinating opportunity to assess the effect of institutionalized learning environments on educational outcomes (Morgan and Winship 2007). These two additional studies focused on an organizational reform (in Thuringia) and a G8 reform (in Baden-Wuerttemberg).

### 14.5.1 Reform of the Curriculum and Organization of Upper Secondary Schooling

A major reform of the *Gymnasium* concerns the curriculum and organization of upper secondary schooling: Baden-Wuerttemberg, Brandenburg, Hesse, Saxony-Anhalt, Lower Saxony, Mecklenburg-Western Pomerania, Hamburg, Saarland, Saxony, Schleswig-Holstein, Bavaria, and Thuringia have already implemented such reforms. Although the exact nature of these reforms differs from state to state (see Trautwein and Neumann 2008; Trautwein et al. 2010a), much more emphasis has been placed on a common knowledge basis for all students in all states, with a lower level of differentiation and student choice in the last 2 years of school, and less choice in the final examination (*Abitur*). For instance, students in most states no longer have to decide whether to study math and German at an advanced (*Leistungskurs*) or a basic level (*Grundkurs*). This development was subject to criticism (Huber 2008) and stands in marked contrast to reforms in other countries such as Sweden and the Netherlands (Mitter 2003) in which the degree of individualization has been increased.

Very little is known about the consequences of the effects of organizational and curricular reforms in the various states. Trautwein et al. (2010b) have performed a comparably systematic analysis of the organizational and curricular reforms in Baden-Wuerttemberg. At the traditional *Gymnasium*, these reforms led to an improvement of one-sixth of a standard deviation for preuniversity mathematics achievement, whereas average English achievement remained unchanged.

The organizational reform in Thuringia, the subject of an additional NEPS study, aimed mainly toward a broader education instead of a high degree of specialization without making any alterations to the official curriculum. The reform for the traditional *Gymnasium* was implemented in 2009 (hence, the first cohort left school in 2011).

The main research questions in the context of the study in Thuringia are: Does the abolition of the advanced and basic courses lead to changes in the average level of student achievement accompanied by a lower variability? Which effects of the reform are expected from the viewpoint of students, parents, and teachers? Furthermore, how do students and their parents judge the requirements concerning achievement, teaching, and homework time both before and after the implementation of the reform? Are there reform effects on students' motivation and academic self-concept in different subjects or on their well-being? Does the reform increase students' aspirations for higher education—particularly in the domain of science? First results on some of these questions can be found in Hübner et al. (2018).

*Sample* The first assessment in Thuringia (last cohort before the reform) took place in January 2010; the second (first cohort after the reform) was conducted in January 2011. At the first assessment (participation rate: 74%), more than 1,300 students participated. Details on the sampling design and data on the additional study in Thuringia can be found in IEA DPC (2010, 2011a) and LIfBI (2015a).

In the Additional Study Thuringia, students were asked to participate in student competence tests and complete a student questionnaire. Furthermore, their parents and teachers were asked to fill out specific questionnaires.

*Student Competence Tests.* These assessed domain-general cognitive functions and domain-specific cognitive competencies (mathematics, English, biology, and physics achievement). In the first wave, 1,374 (participation rate: 74%) and in the second wave, overall 900 (participation rate: 64.7%) students worked on at least one of the four competence tests. Further information on the competence tests is provided on the NEPS homepage. The competence tests were analyzed using item response theory (IRT). The resulting weighted maximum likelihood estimates (WLE; Warm 1989) are provided in the Scientific Use File of the Additional Study (e.g., Rieger et al. 2018).

*Student Questionnaire.* Central aspects covered by the student questionnaire are the expected reform effects, *Wissenschaftspropädeutik*, perceived (academic and time) demands of school, learning environment, parental aspirations, self-concept, motivation, interest (academic and vocational), personality, leisure activities, health complaints, occupational aspirations, intention to study, social background, and migration status. Here, 1,372 (participation rate: 73.9%) students participated in the first and 899 (participation rate: 64.6%) students participated in the second assessment.

*Parent Questionnaire.* This questionnaire focused on parents' expected reform effects, parents' educational and vocational aspirations for their child, perceived (academic and time) demands of school for their child, and social and migration status. Overall, 1,857 parents were asked to answer the parent questionnaire in the first assessment and 575 of them participated (participation rate: 31%). In the second assessment, 30.1% of the gross sample of 1,392 parents completed the questionnaire ( $N = 419$ ).

*Teacher Questionnaire.* The main focus of the teacher questionnaire was on teachers' satisfaction with the course, stress in teaching the course, perceived teaching effectiveness, expected reform effects, and appropriateness of the level of students' choice (organizational aspects of the *gymnasiale Oberstufe*). Overall, 417 (participation rate: 80.4%) of the gross sample of 519 teachers completed the questionnaire in the first assessment, whereas 80.3% (310) of the 426 teachers asked to participate in the second assessment completed the questionnaire.

### 14.5.2 From 9 to 8 Years: the Introduction of the G8 *Gymnasium*

By the time NEPS started, most German states had switched from a 9-year (G9) to an 8-year (G8) *Gymnasium* system, meaning that *Gymnasium* students who did not repeat any years would finish school after 12 rather than 13 years. This change was being



implemented sequentially in the different states (first G8 cohorts:<sup>2</sup> 2007 in Saxony-Anhalt, 2008 in Mecklenburg-Western Pomerania; 2009 in Saarland; 2010 in Hamburg; 2011 in Bavaria and Lower Saxony; 2012 in Baden-Wuerttemberg, Berlin, Brandenburg, and Bremen; 2013 in North Rhine-Westphalia and Hesse; 2016 in Schleswig-Holstein). As noted above (Sect. 14.1), in recent years, many states have switched back from a G8 to a G9 system. Investigations on the effects of G8 reforms seem to imply decreasing mathematical achievement in Saxony-Anhalt (Büttner and Thomsen 2010), and less leisure time—stated to be not sufficient for recreation—in Bavaria (Milde-Busch et al. 2010).

An additional NEPS study is focusing on the G8 reform effects in Baden-Wuerttemberg. The following research questions are of major interest: Is the shortening of schooling by one year accompanied by decreased scholastic achievement and domain-general cognitive functions (Ceci, 1996)? Are there negative reform effects on students' well-being and leisure-time activities (e.g., due to having to spend more time doing homework)? Is there an increased need for private tutoring in the G8 *Gymnasium* system? Results regarding these questions using data from the additional NEPS study on Baden-Wuerttemberg can be found in, for instance, Hübner et al. (2017) and Quis (2018).

Similar to the design of the Additional Study Thuringia (see Sect. 14.5.1), students were asked to work on student competence tests in mathematics, English, physics, and biology and to complete a general student questionnaire. Additionally, school principals and subject heads in math, German, and English were asked to work on a questionnaire.

*Sample.* In Baden-Wuerttemberg, 50 schools were sampled and asked to participate in three subsequent assessments from 2011 to 2013. Of these 50 schools, 48 agreed to participate in the Additional Study Baden-Wuerttemberg. Overall, 1,284 students, 130 head of department teachers, and 40 school principals were assessed in 2011, whereas 2,427 students, 128 head of department teachers, and 44 school principals participated in the second assessment. In the last assessment, 1,214 students 117 head of department teachers, and 44 school principals participated. The number of students who were willing to participate in the survey ranged between 67.7% (gross sample:  $N=1,909$ ) in the last assessment and 72.2% in the first assessment (gross sample:  $N=1,858$ ). Details on the sampling design and data of the Additional Study Baden-Wuerttemberg can be found in IEA DPC (2011b, 2012, 2013) and LifBI (2015b).

*Student Competence Tests.* These assessed domain-general cognitive functions and domain-specific cognitive competencies (mathematics, English, biology, and physics achievement). In the first assessment, participation rate was higher or equal to 94.1% of

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<sup>2</sup>Saxony and Thuringia have always had an 8-year *Gymnasium* school system. Rhineland-Palatinate is the only state that has not switched to a G8 system in general, but is reducing the last G9 school year by approximately 3 months.

all administered tests ( $N=1,341$ ), in the second assessment, participation rate in student competence tests was higher or equal to 88.1% ( $N=2,698$ ), and in the third assessment it amounted to 91.6% ( $N=1,292$ ). Further information on the competence tests are provided on the NEPS Homepage. The competence tests were analyzed using item response theory (IRT), and the resulting weighted maximum likelihood estimates (WLE; Warm, 1989) are provided in the Scientific Use File of the Additional Study Baden-Wuerttemberg. Information regarding the scaling procedure can be found in, for example, Hübner et al. (2016) and Duchhardt (2015).

*Student Questionnaire.* Central aspects covered by the student questionnaire are: the expected reform effects, perceived (academic and time) demands of school, learning environment, leisure activities, health complaints, occupational aspirations, intention to study, social background, and migration status. Here, 1,341 students (participation rate: 95.5%) participated in the first, 2,698 students (participation rate: 89.8%) participated in the second, and 1,292 students (participation rate: 93.7%) participated in the third assessment.

*Head of Department Teacher Questionnaire.* Heads of departments were asked about, for instance, the curriculum toward which they oriented their teaching, the expected effects of the educational reform in general and regarding their subject, and the working climate among teachers at the school. In the first assessment, overall 42 heads of departments participated in math (participation rate: 91.3%), 42 in German (participation rate: 91.3%), and 46 in English (participation rate: 100%). In the second assessment, 44 heads of departments participated in math (participation rate: 91.7%), 40 in German (participation rate: 83.3%), and 44 in English (participation rate: 91.7%). Finally, in the last assessment, 37 heads of departments participated in math (participation rate: 77.1%), 41 in German (participation rate: 85.4%), and 39 in English (participation rate: 81.3%).

*Principal Questionnaire.* Principals were asked about, for instance, the expected effects of the reform in general, the expected effects on teacher motivation and teacher effort, and the expected effects on students. In the first assessment, 40 principals participated (participation rate: 87.0%), in the second and third assessments, 44 principals participated (participation rate: 91.7%).

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## 14.6 Conclusion

Because of the longitudinal design, the nationwide sample, and the inclusion of standardized achievement tests, NEPS is providing an excellent database for answering many questions of major scientific and political interest. With regard to upper secondary schooling in the academic track, such questions address, for instance, the comparison of traditional and nontraditional pathways to the *Abitur*, academic achievement levels

of *Abitur* students, social disparities, and the predictive power of indicators of achievement (school grades, competencies, *Abitur* certificate) on students' further development. Furthermore, the additional NEPS studies on two German *Abitur* reforms are delivering valuable information on (not) intended effects of such implementations.

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