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Chapter 1

Introduction – Education, Competence Development and Career Trajectories



Hans-Peter Blossfeld, Gwendolin Josephine Blossfeld, and Sabine Weinert

Abstract A lifespan perspective on development and education and corresponding longitudinal studies have long been proposed scientifically in many disciplines. However, even in the 2000s, little was known about education as a lifelong process or about the cumulative and interactive effects of learning that takes place in different educational settings across the lifespan and comprehensive longitudinal studies were rare. The German National Educational Panel Study (NEPS) was therefore designed to provide longitudinal data on educational trajectories and competence development from infancy to old age, and to make it possible to examine inter- and intraindividual changes and pathways in relation to family, educational institutions, workplaces, private life, and individual characteristics of the target persons. The data also addresses the institutions of the German educational system such as crèches and preschools, primary and secondary schools, vocational training, tertiary education, and opportunities of further learning in adulthood. It further enables the analysis of relevant monetary and non-monetary returns to education over the life course. The chapter briefly introduces important features of the multi-cohort sequence design of the NEPS and discusses the relevance of longitudinal data. Furthermore, it outlines Germany as a special case by introducing specific features of the German education system as well as some international comparative findings. Finally, an overview of the following chapters is given.

1.1 Introduction

A lifespan perspective on development and education and corresponding longitudinal studies have long been proposed scientifically in many disciplines (e.g., Baltes et al., 1980; Coleman, 1981; Elder Jr., 1974; Krupp, 2008; Mayer, 1990). However, even in the 2000s, little was known about education as a lifelong process or about the

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cumulative and interactive effects of learning that takes place in different educational settings across the lifespan and comprehensive longitudinal studies were rare. At that time, and after the so-called PISA (Program for International Student Assessment) shock in Germany, a National Educational Panel Study (NEPS) seemed a desirable tool to empirically investigate these issues and provide relevant data for national and international research. The nationally representative NEPS study was therefore designed to provide longitudinal data on educational trajectories and competence development from early childhood to old age, and to make it possible to examine inter- and intraindividual changes and pathways in relation to family, educational institutions, workplaces, private life, and individual characteristics of the target persons (Blossfeld & Rossbach, 2019). The data should also address the institutions of the German educational system such as crèches and preschools, primary and secondary schools, vocational training, tertiary education, and opportunities of further learning in adulthood. It should further enable the analysis of relevant monetary and non-monetary returns to education over the life course.

- In July 2008, the German Research Foundation (DFG) approved both
- the establishment of the NEPS as a six-cohort panel study (see Fig. 1.1), which was originally funded by the German Federal Ministry of Education and Research (BMBF) and later located at the newly founded Leibniz Institute for Educational Trajectories (LifBi) in Bamberg; and

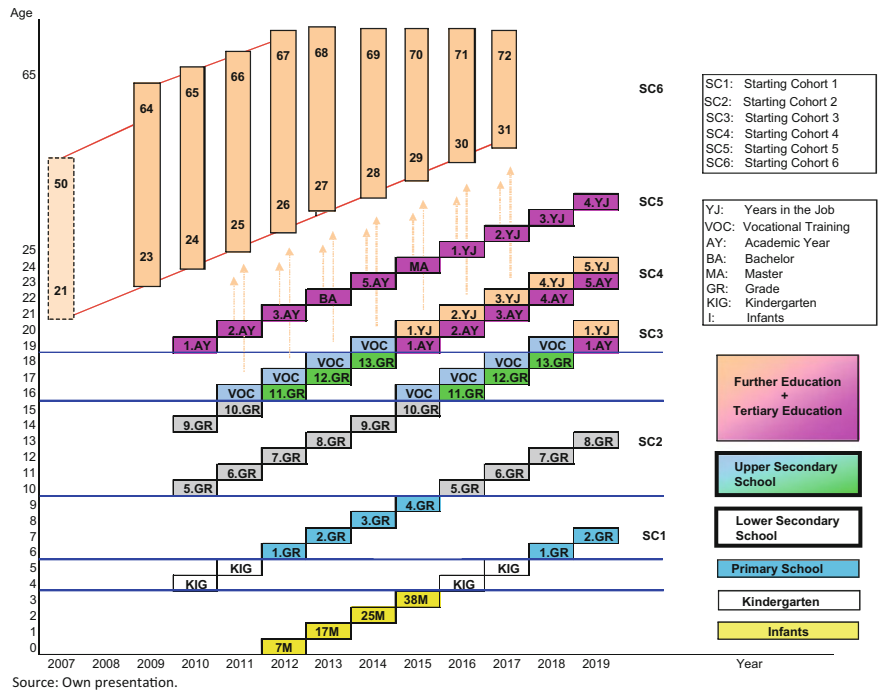


Fig. 1.1 The multicohort sequence design of the early NEPS. (Source: Own presentation)

- the setup of a DFG Priority Programme (SPP 1646) ‘Education as a Lifelong Process: Analyzing Data from the National Educational Panel Study (NEPS)’ with the aim of using NEPS data, which were available to the international scientific community from early on, for the analysis of research questions as soon as possible.

Following approval by the DFG, the first wave of the NEPS Adult Cohort was conducted in 2009. In this dataset, retrospective data on the life histories of adults from the study ‘Working and Learning in a Changing World’ (ALWA) in 2007/08, were integrated into the NEPS design (see Fig. 1.1). In 2010, the first waves of preschool children aged about 4–5 years, secondary school children aged about 10 and 15 years, and first-year students at universities of applied sciences and traditional universities were surveyed in their educational institutions. In 2012/13, the NEPS was expanded to include a representatively drawn sample of newborns, with the first wave of the survey conducted in children’s homes at about 7 months of age. Overall, about 60,000 target persons from these representative six starting cohorts were then followed up through annual sweeps. The annual panel surveys include competence tests and interviews with target persons and – at least for the younger cohorts – also interviews and questionnaires with parents and students’ teachers and school principals as well as observational measures in the very early years. The NEPS database is an infrastructure facility for education and social sciences and each new wave of this panel study is made available to the scientific community as fast as possible (<https://www.neps-data.de/Data-Center/Data-and-Documentation>).

The main goal of the research programme of the DFG priority programme (SPP 1646) was to utilize the NEPS data for substantive analyses as quickly as possible, to test theoretical models from various disciplines (e.g., psychology, sociology, education, economics, migration and health research, and demography), and to gain insights into the development of competencies, the importance of learning environments, the processes of educational decision making, the particular constellations of competence acquisition/development among individuals with a background of migration, and the opportunities and risks of different educational pathways (<https://spp1646.neps-data.de/>). These processes could also be linked to data on monetary returns to education such as income trajectories, changes in job quality, occupational careers, and class mobility, as well as on non-monetary returns to education such as health status, family formation, demographic behaviour, socio-emotional, behavioural and personality development, social and political participation, and subjective well-being over the life course. As the dynamic analysis of educational processes has extremely accelerated in recent years (see Börsch-Supan et al., 2016), an important goal of SPP 1646 was also the development and application of advanced statistical methods for the analysis of (multilevel) longitudinal data (Blossfeld et al., 2016a).

This book presents results of 17 SPP 1646 research projects funded from 2012 to the present. It is organized as follows: After this introductory chapter discussing the strength of the NEPS longitudinal database for national and international research, the chapters presenting important findings of the SPP projects are divided into four thematic parts: (1) ‘Competence and Skill Development: Individual Characteristics,

Learning Environments, and other Contextual Factors’, (2) ‘Educational Transitions and Pathways: Influencing Factors and Outcomes’, (3) ‘Vocational Training and Labour Market’, and (4) ‘Individuals with Migration Background’. The chapters thereby provide insights into education as a lifelong process from infancy until late adulthood.

1.2 The Relevance of Longitudinal Data for the Study of Education: Competence Development, Educational Pathways, and Careers Across the Life Course

In modern knowledge societies, education has become not only a key factor for individual productivity and economic growth, but also crucial for meeting the individual and societal challenges of a rapidly changing globalized world (Blossfeld et al., 2005). Moreover, in democratic societies, education is also an important prerequisite for active participation as reflective citizens (OECD, 2006). Equal educational opportunities for all social groups (such as social class, people with migration background, and gender) are therefore widely accepted as an important policy priority in all modern societies (OECD, 2006).

The results of the early PISA studies, however, have shown that large sections of German students at the end of their schooling were not only inadequately prepared for the challenges of a modern society, but the analyses also revealed a strong correlation between social background and competencies of students in Germany.

Cross-Sectional Versus Longitudinal Data Although several cross-sectional surveys such as PISA, the Trends in International Mathematics and Science Study (TIMSS), or the Progress in International Reading Literacy Study (PIRLS) in the 2000s provided important data on the distribution of students’ competencies at the end of primary school and at age 15 in secondary school, they were merely individual snapshots reflecting the achievement situation at a particular age and are therefore of limited value in addressing the question of how educational outcomes were produced over time (Coleman, 1981). Thus, in the 2000s there was a strong desire to establish a study that collects longitudinal information on educational careers and competence development and traces individual trajectories over longer life spans (Börsch-Supan et al., 2016). The NEPS offers such data for Germany so that individuals’ life history experiences in the past can be linked to their educational outcomes at later points in their lives so that one can better understand how those outcomes came about.

This longitudinal perspective has led to a crucial shift in the way educational researchers have approached issues of schooling, skills, competence, and attainment. It redirected attention on the processes of education and competence development and linked the changing institutional and social context to the unfolding of human learning in the life course (Baumert et al., 2014). It also serves as a bridge between psychological and sociological perspectives and between individual development and (changing) institutional and social contexts (Blossfeld & Rossbach, 2019).

Education as a Lifelong Process In the 2000s, educational researchers have also emphasized the need to integrate all educational phases over the life course in longitudinal designs. Thus, compared to traditional educational research that focused mainly on students in schools, vocational training institutions, or the university, there was a strong desire to collect also longitudinal data on the period before and after these educational institutions. The influential Perry Preschool study provided evidence that supporting children from less privileged families in preschool institutions has a positive long-term impact on outcomes in adult life (Heckman & Masterov, 2007). Thus, the NEPS integrated the first years of life in the family, in early extrafamilial childcare, and in preschool institutions into the longitudinal design. The other major concern has been to include the increasing importance of lifelong learning in the NEPS longitudinal study. For members of the modern information and service economy, learning does not end with the attainment of a degree in the general education system, the vocational training system or the higher education system. Rather, after school they are required to continuously acquire new knowledge and skills throughout their adult lives. Accordingly, the NEPS also collected data on adults' learning trajectories and competence development during their professional careers, personal adult lives, and even after retirement.

Conceptional Principles of Life Course Research The design of the NEPS was shaped by five conceptional principles of life course research, as formulated by Glen H. Elder Jr. et al. (2004) (see Blossfeld & Rossbach, 2019): (1) focusing on long-term educational processes over the individual lifespan (across all the stages of education as a lifelong process); (2) considering individual educational pathways within their institutional and social embeddedness (e.g., within not only formal educational institutions but also non-formal and informal contexts such as the family, peer groups, and other social networks); (3) analysing decision-making processes in education in relation to the idea of agency, planning by individuals and creative, self-determined actors; (4) investigating the relevance of the time structure and timing of educational events and transitions and the consequences they have for the subsequent educational chances, pathways and success; and (5) distinguishing important dimensions of time such as age, cohort, and period influences as well as the relevance of different places (regional contexts, Federal States in Germany, East and West Germany, or specific neighbourhoods, localities, and residences).

The *first life course principle* means that educational research focuses on long-term individual development over the lifespan in its descriptions and analyses. Although a bio-social and lifelong perspective on development and learning is widely accepted in developmental psychology, researchers have often worked with the concepts of stages, progression, growth, differentiation, and evolution when studying learning processes. The resulting emphasis is on systematic development pathways over time. An innovative theoretical (and methodological) feature of the NEPS is that it suggests and opens up the possibility to formulate and empirically evaluate developmental models that track competencies at different stages of education and across the lifespan. In this respect, the NEPS assesses domain-general cognitive functions, the dynamics of domain-specific cognitive competencies with a

special focus on German-language competencies and reading literacy in particular, mathematical literacy, and scientific literacy. Furthermore, meta-competencies such as information and communication technologies (ICT) literacy and facets of meta-cognition and self-regulation are assessed and complemented by indicators of general knowledge and facets of socio-emotional, behavioural and personality development. And finally, educational stage-specific measures, such as observational measures in infancy or curriculum- or job-related competencies and outcome measures are included.

Sociological life course approaches, while incorporating also notions of individual development such as aging and growth, emphasize the importance of contextual influences on the temporal course of individual development. Consequently, important aspects of educational careers are the time-varying educational contexts that foster or hinder learning and educational progress. Learning contexts can be formal (e.g., school, apprenticeship, college), non-formal (e.g., on-the-job training, courses offered by sports clubs, music schools, and child and youth services), or informal (e.g., peers, media). The family is a particularly important informal learning environment systematically captured in the NEPS.

For social scientists, education as a lifelong process is therefore highly age-differentiated, as age often formally influences the passage through educational institutions. Primary and secondary schools in Germany are strictly graded by age. Curricula prescribe a certain number of hours of instruction, courses must be completed in a specific order, and there are deadlines for obtaining certificates. In Germany, there is a more informal age structuring after compulsory schooling in vocational training, tertiary and continuing education, so that the timing of stages and transitions is less standardized. In these less standardized life stages, it is therefore important to examine how individuals self-regulate their educational development.

The movement of individuals through the education system is a central focus of the NEPS. The concept of the career is used to refer to an individual's sequence of roles in this process. Kerckhoff et al. (1996) have suggested that the concept of educational career should be considered synonymous with educational trajectory. The conceptual tool of trajectory encompasses sequences of different qualitative states as well as continuous increases or decreases in quantitative characteristics of, e.g., competence development or competence trajectory. Educational careers often depend strongly on the structural features of the educational and employment systems and thus draw attention to the ways in which opportunity structures shape individual careers. The NEPS traces individuals' careers and transitions from early childhood through crèche and preschool, elementary school, lower and upper secondary education, postsecondary education (including vocational education and training as well as university education), entry into the labour market, subsequent job careers, and entry into new activities after retirement.

Life course research also emphasizes that the events and conditions of earlier stages of education often have an impact on later educational processes and outcomes. Dannefer (1987) introduced the so-called Matthew effect to the life course literature. This effect means that initial educational inequalities become more

pronounced over the life course. The Matthew effect is sometimes referred to as the cumulative disadvantage/advantage hypothesis (O’Rand & Henretta, 1999). This cumulative effect seems to be particularly important in the case of continuing education, since earlier education, training and achieved degrees entail further learning. Educational research has paid relatively little attention to the challenges associated with describing and explaining long-term educational trajectories because longitudinal data over long periods of life have rarely been available.

The *second life course principle* concerns the interdependence of lives over time, particularly in the family, where individuals are connected across generations through kinship ties and processes of intergenerational transmission (Moen & Hernandez, 2009). The NEPS provides data on long-term relationships between parents and children and how these relationships influence the educational careers of children, adolescents, and adults over the life course.

The ‘linked lives’ principle also refers to important relationships outside the family. These include the interactive influences of institutions such as crèche, preschool and school, neighbourhoods, and peers. Preschool education and care institutions as well as schools are important organizations with which children come into contact, and they constitute a large part of most children’s lives. In the school environment, knowledge is constantly tested, evaluated, and compared with other students, and children develop a sense of their intellectual efficacy. Research has shown that self-efficacy beliefs formed early in life tend to be self-fulfilling, either encouraging or discouraging students from taking risks and engaging in new and challenging tasks (Marsh et al., 2006). Schools also provide a conducive environment for the emergence of peer groups. Bandura (1997) noted that peers are the most important reference group in late childhood and adolescence because of similarities in age and experiences. The NEPS can be used to examine the role of such social networks, specifically how individuals’ educational and vocational decisions are shaped by interactions with others.

The *third life course principle* means that agency in human development and the idea that planned behaviour and intentions can influence processes and outcomes in the life course. From a psychologist’s perspective, the self is at the core of human agency. For instance, Bandura’s (1982) social cognitive theory of self-efficacy views humans not simply as reactive beings influenced by external events, but as acting, self-regulating, creative, and proactive beings. Self-efficacy refers to the perception of oneself as a causal agent in one’s environment. Such beliefs are an important basis of action and interaction throughout life. Individuals are active agents in shaping their lives and make choices within the constraints of institutional and sociohistorical structures.

In sociology, the idea of agency is closely linked to the so-called theories of methodological individualism and rational action theory – that is, theories that assume that the macrolevel aggregates of educational inequality have to be reconstructed via the educational and occupational choices that individuals make under conditions of uncertainty over the life course. The NEPS can be used to examine the extent to which educational decisions such as early or late enrolment in preschool and school, choice of a secondary school pathway, choice of a profession, choice of a study course, continuing education, or participation in further training vary across socio-economic

groups and gender. These differences in educational choices can be found even if the levels of competence are comparable and are partly moderated by state-specific regulations in Germany. The NEPS thus allows to analyse the importance of class-specific educational aspirations, motivations, expectations of success, and cost assessments. In addition, it provides data for examining gender-specific development of subject choices in educational trajectories (courses in school, types of vocational training, choice of studies at tertiary education).

The *fourth life course principle* emphasizes that developmental consequences of life transitions vary depending on their timing in a person's life. It recognizes that the impact of life events depends on when they occur in an individual's life. Therefore, it is necessary to recognize single and multiple risks associated with the timing of transitions. These transitions result from the fact that the educational system consists of different types of institutions. In Germany, decisions about educational transitions, once made, are often difficult to revise. The most 'vulnerable' phases in an educational career in Germany are (a) the time of entry into crèche or preschool and into the formal school system, (b) the time of transition to secondary school ('Hauptschule', 'Realschule', or 'Gymnasium'), (c) the time of transition from secondary school to vocational training, higher education or the employment system.

The *fifth life course principle* of time and place states that individuals' educational careers are embedded in specific historical times and places. Life course research has demonstrated the necessity of embedding individual lives in these social and historical contexts. Life-course researchers often refer to a set of mechanisms such as the age-period-cohort model of social change. The age effect in this model means that individuals change with age due to a combination of biological, psychological, and social mechanisms. The period effect states that all individuals - regardless of their specific stages in the life course - are affected similarly by the same time-historical conditions. Finally, the cohort effect refers to a persisting change across successive (birth) cohorts, as specific groups of individuals experience historical conditions at different critical life-course periods or transitions in their lives (e.g., changing transition rules from elementary to secondary school that increase or decrease the opportunities to move to upper secondary school (Gymnasium), or changing labour market conditions at the time of entry into vocational training). The cohort sequence design of the NEPS, which follows repeated cohorts over longer periods of their lives (see Fig. 1.1), provides an appropriate way to identify age, period, and cohort effects. In addition, modern multilevel modelling techniques allow researchers to specify more precisely the complexities of time and social environment for educational processes.

Educational Processes of Migrants Finally, migration processes have increased their importance for education in recent decades. Ethnic or national origin, migration biography and their contextualization (in particular, the language spoken in the family, relations to the country of origin, integration in ethnic communities and networks, religious orientations) are significantly related to educational choices and competence development beyond the mechanisms of social inequality. One focus of the NEPS is therefore the assessment of migrant students' knowledge and competencies in the language of their parents' country of origin. Majority and minority

language acquisition provide a major approach for explaining success in education and in the labour market. The NEPS initially focused on two migrant groups in Germany, migrants with a Turkish background and ethnic German immigrants from the former Soviet Union. However, NEPS also addresses new waves of migration in Germany in recent decades and their characteristics.

1.3 Germany as a Special Case

Cross-national comparative studies have shown that educational disparities by social background are still quite common across industrialized societies (Becker & Schulze, 2013; Blossfeld et al., 2016a; Breen & Müller, 2020; Duru-Bellat & Suchaut, 2005; Horn, 2009; Marks, 2005; Olczyk et al., 2021; Shavit & Blossfeld, 1993). However, these studies also demonstrate that the German education system is a particularly unequal institution. It is characterized by (1) a comparatively low participation of children under age 3 in preschool institutions, although this has changed somewhat in recent years, (2) the great importance of early tracking at age 10 or 12 (i.e. the assignment of students to different types of secondary schools, namely ‘Hauptschule’, ‘Realschule’, and ‘Gymnasium’), (3) the strong stratification of the general school system that makes it difficult or even impossible to revise the early educational choices, (4) the relatively rigid ‘dual system’ that dominates the vocational training system, and (5) the comparatively low participation rates in formal or informal adult learning (see Blossfeld et al., 2014, 2015b, 2016b, 2017). Since the NEPS and the SPP 1646 projects in this book focus on Germany, we briefly discuss the specific features of the German education system as well as some international comparative findings.

Early Childhood Education and Care In Germany, investment in early childhood education was not on the political agenda until the 2000s, as parental care was seen as falling outside the scope of public policy. As a result, parents were regarded as largely responsible for passing on early competencies and knowledge to their own children. Nonetheless, in the early 2000s about 90% of a birth cohort in Germany attended preschool at the age 4–5 (Statistisches Bundesamt, 2008). Since several US longitudinal studies of children from very disadvantaged families have shown in the 2000s that early educational investments can effectively increase children’s cognitive and socio-emotional skills and even change their long-term educational and labour market prospects (Barnett, 1995; Heckman, 2006), a massive reorientation of German public policy toward more formal childcare rapidly transformed the German preschool educational settings, especially for children under age 3. In particular, during the last 15 years, the growing demand for early child education and care (ECEC) for children under the age of three led to the enactment of laws and the expansion of childcare infrastructure for infants and children in Germany (see Weinert et al., 2016 for a brief description). Furthermore, in 2013, the legal right to institutional ECEC was expanded to include 1-year-old children. Accordingly, the

actual use of childcare for young children under the age of three rapidly changed in Germany: Between 2005 and 2013, the childcare rates for the under 3-year-olds increased from 7% to 23% in the Western states of Germany and from 36% to 47% in the Eastern states, which have their own distinct tradition and infrastructure concerning ECEC (Kreyenfeld & Krapf, 2016). In 2015, the nation-wide care rate amounted to 32.9% with mean values of 28.2% for the Western and 51.9% for the Eastern states (Statistisches Bundesamt, 2016). However, despite rising rates of early education, a child's family still is the first and often only environment for developmental processes during the first years of life. In particular, an early use of extrafamilial childcare is substantially related to the socio-economic status of the family (see below). With an attendance rate for 3- to 6-year-olds of 93.6% in Germany, almost every child in this age group has some ECEC experience. The rate for the under-3s is 33.1% (2.2% for 0- to 1-year-olds, 36.6% for 1- to 2-year-olds and 61.9% for the 2- to 3-year-olds; German Federal Statistical Office, 2017).

In a cross-national study, Blossfeld et al. (2017) examined families' childcare decisions, the role of early parental involvement and care for educational success and achievement gaps, and the consequences of early education and care for social inequalities in educational opportunities over the life course across 12 countries. This comparative study showed that not only does the availability and quality of childcare vary across countries (and over time), but there are also large cross-national differences in the diversity of *childcare options and services*. For instance, while early childhood education in the United States varies widely in quality (e.g., Vandell & Corasaniti, 1990) and is highly market based (Kamerman & Waldfogel, 2005), early childhood programs in Europe tend to be much more standardized through government regulation, and the services offered are more homogeneous and are provided more widely (Spiess et al., 2003). Nonetheless, the organizational characteristics of childcare systems vary considerably even within Europe due to diversity of country-specific social and educational policies.

The study by Blossfeld et al. (2017) first examined parental engagement, which focuses on physical care, the promotion of intellectual skills and social behaviour or, more generally, the investment of time and material resources in children. Results from the NEPS Newborn Cohort Study showed early associations between the family's socio-economic status (SES) and maternal interaction behaviour as well as a mutual interrelation between maternal and child behaviour in early mother-child interaction (Weinert et al., 2017) and allows insights into the early emergence of SES-related disparities in early child development (see also Attig & Weinert, 2020). Based on the cross-national comparison, it was concluded that in all analysed countries educational inequalities in the family are created and maintained very early in a child's life – long before school age. In a recent six country comparison study with harmonized data across countries, the home learning environment was the only measure that significantly explained SES-related gaps in all child outcomes and across all countries under study (Volodina et al., 2022).

In addition to parental care, the Blossfeld et al. (2017) study considered two other main forms of childcare: *informal and formal childcare*. Informal care includes a variety of actors who care for the child, such as grandparents, other relatives, friends,

neighbours, and babysitters. Formal childcare refers to institutional forms of care, such as public or private nurseries. The authors were particularly interested in whether and to what extent the decisions about different forms and times of childcare are influenced by maternal education, household wealth and income, as well as parental social class in different countries. The general results (including Germany) show that families with a lower social position rely more heavily on parental care, while families with a higher social position more often rely on formal or informal childcare. A general result is also that parents enrol their children earlier when the quality of institutional care is high and prefer to wait when the quality is low. Several country-specific case studies in Blossfeld et al. (2017) were able to assess the short and longer-term consequences of children's experiences of early formal care. For example, a German study on preschool children born in 2005/06 provided evidence that earlier enrolment in a centre or group-based care (day care centres, crèches, or playgroups) is associated with higher linguistic competencies at age five for all children (Dämmrich & Esping-Andersen, 2017). With respect to facets of socio-emotional development, the effects of very early ECEC are less clear and vary across different ECEC systems/characteristics (see e.g., Linberg et al., 2020). NEPS data allow to study the joint effects and interactions of the home learning environment and the use of ECEC while considering other influential factors (such as family structure, SES, health) for different outcome measures (e.g., Linberg et al., 2020) as well as for explaining the emergence of SES-related gaps in an international comparison (Volodina et al., 2022).

In Blossfeld et al. (2017), several country-specific studies examined also the role of the quality of preschool centres or the quality of specific programs in offsetting the early disadvantages of children from lower social background. They found a strong correlation between the quality of preschool institutions and the growth of cognitive and so-called 'non-cognitive' skills among disadvantaged children.

The main theoretical conclusions of the cross-national comparative study by Blossfeld et al. (2017) on the effects of early childcare drawn by the authors were: (1) that all young children benefit from early childcare (general elevator effect), (2) that disadvantaged children profit more than children from advantaged parental homes (interaction effect), and (3) that social achievement gaps between children from unequal social backgrounds (caused by the family effect) are only moderately reduced by attending early education and care institutions. The fast expansion of early childcare and education institutions in Germany since the early 2000s was therefore an important step forward. However, not only should access to formal childcare be improved at earlier age, but also quality of these services offered in these institutions should be ensured. In terms of the quality of preschools, Germany still ranks in the middle internationally.

Early Tracking After Primary School Blossfeld et al.'s (2017) country-specific studies on early childhood education and care have made it clear that students' academic performance at school entry is closely related to their family background in all countries. Schools in modern societies have two important goals: (1) to provide all students with a common foundation of competencies for full participation in

society and socio-economic life, and (2) to sort and select students according to their abilities and different life goals (Van de Werfhorst & Mijs, 2010). As a result, sooner or later in the school career in modern societies, students are sorted in different school types, educational tracks, achievement groups, curricula, or subjects (see Blossfeld et al., 2016b). In the literature, the two ideal-typical approaches to sorting in secondary education are described as tracking and comprehensive schooling. In countries with comprehensive school systems, students remain together until around age 16 and are offered different curricula, resulting in a complex differentiation of the educational landscape in these schools. Germany is a country with a traditionally rigid system of early tracking (at age 10 or 12) in the transition from primary to secondary school. This organizational feature of the German education system makes parents' school decisions and primary school teachers' (achievement-based) recommendations an important event in the school careers of German students. Research in sociology of education in Germany is therefore examining the role of students' academic performance and social background (or migration) characteristics for individuals' educational transition probabilities from primary to upper secondary school.

Stratification of Secondary Schools Despite increasing permeability between the main secondary school types in Germany ('Hauptschule', 'Realschule' and 'Gymnasium') in the last decades and a rising proportion of students attending comprehensive schools, early track assignment in the German secondary school remained difficult to revise (Blossfeld, 2018; Zielonka, 2017). Secondary school in Germany is still characterized by a comparatively high degree of stratification. Only after the successful acquisition of a lower secondary degree ('Hauptschulabschluss' or 'Mittlere Reife') is access to higher education opened up by the introduction of new second-chance educational pathways; for example through the establishment of specialized secondary schools (so-called 'Fachoberschulen' and 'Berufsoberschulen') and the introduction of professional colleges ('Fachhochschulen') next to the traditional universities (see Blossfeld et al., 2015a) in the German higher education system. Analysing the links between social background and pathways through traditional 'Gymnasium' and the various forms of second-chance education is a promising topic.

Vocational Training and Education Vocational training is organized very differently in modern societies (Blossfeld, 1992). It takes place in general schools, vocational schools, training centres, the so-called dual system, or in the form of simple on-the-job training at the workplace. The different forms of vocational training have different weight in national training systems. In France, for example, most vocational education takes place in the general educational system, while in the Netherlands and Sweden vocational training is mainly provided in vocational schools. In Italy, the United Kingdom and the United States many school leavers enter the workforce directly and acquire vocational qualifications through on-the-job training at the workplace. In Germany, Denmark, and other German speaking countries, the 'dual' apprenticeship system is the dominant type of vocational training leading to a clear institutional separation between general education and

vocational training. The ‘dual system’ combines in plant training with part-time vocational school.

The growing popularity of the German dual training system in industrialized countries is due to the fact that this system is able to offer a pragmatic compromise of theoretical learning in part-time schools and workplace-related experience for a large number of occupations. In this system vocational experiences are not only simulated in school but gained in the real work situations (Blossfeld, 1992). On the other hand, young people can also acquire a broader theoretical understanding of their occupational activities through more general education in part-time vocational schools, enabling them to behave flexibly as occupational requirements change rapidly over the working life and the lifespan of occupations is shortened.

Compared to other vocational training forms, the German dual system has an additional major advantage: It enables a large number of young people to make a smooth transition from the general school to the employment system because it serves as a bridge. This leads to comparatively low youth unemployment rates in the countries with a dual system (Blossfeld, 1992).

Empirical studies have shown that in Germany the proportion of unskilled workers in each generation is strongly linked to economic and demographic conditions at the time when young people are leaving school and seeking training. In times of economic crisis, the likelihood then increases that a high proportion of young people will not find a training place and will remain unskilled. In the German system it is however difficult for these unskilled workers to take up vocational training later in life, even if the macroeconomic situation has changed. As a result, the proportion of unskilled workers in these generations tends to remain stable throughout the rest of their working lives (Blossfeld, 1992). This is considered a great weakness of the German dual training system.

Another weakness is that in the course of educational expansion, upper secondary school and university degrees have become an increasingly important factor for access to higher-level, planning and managerial jobs and have devalued the experience of dual training and professional careers. In this way, vocational training in the dual system is threatened to lead to a dead end in career.

Adult Learning In modern globalized societies, it is becoming increasingly important to keep employees’ skills constantly up to date throughout their professional and private lives. It is therefore no longer appropriate for education to take place exclusively at the beginning of the life course in preschools, schools and vocational training institutions. In most modern societies, the primary policy focus with regard to adult learning has therefore been to increase participation rates.

Blossfeld et al. (2014) used longitudinal data from 13 countries to examine cross-national patterns of participation in various adult education activities and their effects on individual labour market trajectories using a life course approach. They focused on labour market-related learning because of the central role of employment in modern societies and examined formal and non-formal adult learning. Formal adult education is learning that leads to recognized certificates that can also be earned along the typical educational career path and often takes place in formal

educational institutions. In contrast, non-formal adult education consists of (often) shorter training courses and is often at least partially sponsored by employers. Nevertheless, non-formal adult education can also be certified, but these certificates are not as widely recognized qualifications as those in formal education.

In Germany, the majority of individuals (about 70% in the sample) never re-enter any kind of structured and more formalized education or training after labour market entry. In cross-national comparison, in particular with Scandinavian countries, this is a relatively high proportion. Additionally, those 30% who receive education or training after their labour market entry mainly participated in occupation-specific training, which is usually certified. This fact is not surprising since the German labour market is well-known for holding certificates in high regard. It must be noted that such occupational training in adult life is mainly occupation-specific add-on training and hence does make it difficult for persons to change their occupational field. Instead, such training 'only' complements persons' initial vocational training certificates. Entries into educational programs that would allow persons to significantly upgrade their initial educational level (by aspiring to a higher secondary schooling degree or by entering tertiary education) are very rare once persons have left the educational system for more than 6 months. If such education programs are started at all, it is mainly very young people who (re)enter secondary or tertiary education. Those who are least qualified when they enter the labour market are also the least likely to receive valuable additional training afterward. Instead, the least skilled rely on welfare state-supported training programs, but these are not well recognized in the labour market. In fact, the German analyses show that participation in such welfare state-supported training programs does not improve the labour market situation, especially for men. All in all, these findings suggest that the German adult learning system prolongs and, in some cases, reinforces already existing social inequalities. Adult education in Germany is not able to substantially reduce already existing educational inequalities, as those who would need further education (i.e., individuals without vocational training) hardly receive any valuable further education afterwards.

The most consistent pattern found in the analyses of Blossfeld et al. (2014) is that of a cumulative advantage, in which those who are already better endowed also receive more learning opportunities in adult lives (Matthew effect; see Dannefer, 1987). One reason for this appears to be that the more highly educated are more trainable, meaning that each unit of training produces a larger increase in productivity for highly educated workers than for those with lower levels of education (Blossfeld et al., 2014). Moreover, the occupations in which high-skilled workers work are likely to require more training because they are knowledge-intensive and require knowledge and skills to be constantly updated, while low-skilled jobs may remain more stable in their required tasks but have a greater risk of becoming obsolete in the long run due to technological innovation (Blossfeld et al., 2014). Thus, adult education in general tends to replicate and reinforce the outcomes of initial education, especially in Germany. NEPS data will help to explore these issues further and across time.

1.4 The Structure of the Book

Based on the theoretical priorities of the NEPS, the projects of the SPP 1646 focused on central aspects of education as a lifelong process. The chapters provide an insight and overview of important results and serve as instructive examples of how new substantive insights into education as a lifelong process can be gained. The following structure organizes the 17 chapters into four thematic sections of the book.

The first part ‘Competence and Skill Development: Individual Characteristics, Learning Environments, and other Contextual Factors’ (six chapters) highlights the importance of differentiated measures of early learning environments, documents how students benefit from varied instructional styles and class composition, indicates that gender differences increase over the educational career with regard to chosen subjects, and shows how competencies develop across the lifespan. It also includes a chapter on a novel methodological approach to study educational achievement by combining longitudinal and local structural equation modeling.

The second part ‘Educational Transitions and Pathways: Influencing Factors and Outcomes’ (four chapters) shows how educational transitions in secondary school and transitions to and out of higher education depend on social origin. Furthermore, it is analysed and documented how contextual settings (neighbourhoods and regional contexts) are relevant for educational inequalities. Overall, this part confirms and provides insights into the complex relationships between socio-economic contexts and inequalities in education.

The third part ‘Vocational Training and Labour Market’ (four chapters) demonstrates that the potential of low-achieving school leavers often remains undiscovered and that they, as a result, often do not manage to enter vocational education (even several years after leaving school). Further results highlight that gender-specific employment trajectories are structured mainly by occupational preferences and characteristics. In addition, data on employees’ decision to participate in further training is documented and explained by employers’ financial support.

The last part, entitled ‘Individuals With Migration Background’ (three chapters), examines and discusses how educational success of immigrant children depends on their first language. It also suggests that the general motivation of non-institutional social contacts to provide support to students at the transition to vocational/educational training does not differ between natives and migrants. Finally, it indicates that Turkish girls have less gendered aspirations than native females. Addressing a broad range of educational stages and trajectories, the chapters provide insight into education as a lifelong process.

Chapter Overview The second chapter ‘Quality of Early Learning Environments: Measures, Validation, and Effects on Child Development’ by Sabine Weinert, Manja Attig, Anja Linberg, Franziska Vogel and Hans-Günther Rossbach shows that individual differences and disparities in educationally relevant competencies and skills evolve from the very beginning of a child’s life. The chapter focuses on early learning environments as an important basis for the acquisition of competencies and skills that depend and impact on education. Based on the NEPS cohort of newborns

and additional validation studies, the authors address and empirically evaluate different quality measures of parenting behaviour and extra-familial childcare and their effects on early child outcomes. The findings highlight the importance of considering differentiated measures of the early learning environment from the outset, such as indicators of cognitive-verbal stimulation or emotional support from parents, as these are differently related to various domains of early childhood development. In addition, different facets of interaction quality are associated with socio-economic family characteristics (SES), but only moderately related to each other. Furthermore, the authors report on the validity and effects of quality measures of early external childcare in the NEPS cohort of newborns and discuss the emergence of individual differences and SES-related disparities in early childhood development.

The third chapter 'The Emergence of Gender-Specific Competence Patterns and Decision Making During the Course of Educational and Job Careers in Germany' by Loreen Beier, Alessandra Minello, Wilfred Uunk, Magdalena Pratter, Gordey Yastrebov and Hans-Peter Blossfeld shows that there are already gender differences in mathematical competencies at early preschool age, but contrary to the usual expectations in favour of girls. In primary school, the early gender-specific differences are then reinforced: boys perform better in mathematics and girls in German language. However, these relative advantages in the individual domains balance each other out, so that there are no significant differences in overall performance. As far as the transition from secondary school to vocational training or higher education is concerned, the data revealed some indications that young women among school leavers more often opt for vocational training than young men, while men more often than women opt for studies at a university for applied sciences. The authors did not find any gender differences with regard to entry to higher education: women are no less likely to seek access to higher education than boys with comparable grades. Finally, the results show the important role of mothers in shaping the educational attainment of their daughters. In summary, the expected cumulative differences between boys and girls and men and women over the life course seem to be consistent with the so-called Matthew effect hypothesis: The small gender differences at preschool age are getting bigger over the school career, not so much in terms of competence development, but in terms of the choice of school subjects and subjects of study in vocational training and tertiary education.

The fourth chapter 'Patterns and Predictors of Literacy and Numeracy Development During Adulthood: Insights From Two Longitudinal Assessment Surveys' by Clemens M. Lechner shows that literacy (reading competence) and numeracy (mathematical competence) are indispensable prerequisites for lifelong learning and participation in today's knowledge society. However, there is little evidence on the development of these competencies during adulthood. This chapter summarizes the main findings of a project that leveraged the unique potential of two German longitudinal assessment surveys, the NEPS and the 'Programme for the International Assessment of Adult Competencies – Longitudinal' (PIAAC-L), to garner insights into how these competencies develop during adulthood. Both surveys offer repeated measures of adults' competencies at 3–6 year intervals, which allows

the author to provide empirical evidence on two guiding questions: (1) Do literacy and numeracy skills still change in adulthood? If so, are the changes gains or losses, and how are the changes distributed across socio-demographic subgroups? (2) Which individual and contextual factors (e.g., participation in job-related training, engagement in literacy or numeracy practice, or basic cognitive skills) predict change in competence development? The findings suggest that skills develop across the lifespan and may even change over relatively short periods of time. Increases and losses occur in equal measure. Furthermore, the findings suggest that engagement in practice is a crucial factor in changing competencies, while emphasising that engagement in practice itself is dependent on a range of individual and contextual characteristics. The author also discusses methodological insights and avenues for future research that emerged from the project.

The fifth chapter entitled ‘The Interplay Between Instructional Pace, Skill Externalities, and Student Achievement: An Empirical Assessment’ by David Kiss validates a theoretical model from Kiss (2017) that addresses the transmission channels in which an increase in peer achievement can affect the achievement of other students. In this model, a higher proportion of better students has two effects: First, weaker students benefit from skill externalities generated by their better classmates. Second, the better students induce teachers to instruct at a more demanding pace. Based on these two mechanisms, the author derives three hypotheses and tests them using NEPS data on German secondary school students. The empirical findings are consistent with the predictions of the model: Increases in the proportion of better classmates is (a) always beneficial for good students, (b) can have a detrimental effect on weak students, and (c) increases the performance of weak students when the level of interaction between better and weaker students is high. Taken together, these empirical results suggest that encouraging better and weaker students to interact more may be a Pareto improvement.

The sixth chapter ‘Addressing Environmental and Individual Factors in Early Secondary School: The Roles of Instruction Techniques and Self-Perception’ by Jeffrey M. DeVries, Carsten Szardenings, Philipp Doeblner and Markus Gebhardt examines the risk factors for academic performance, such as lower socio-economic status, migrant status, and the presence of special education needs. Learner self-concept, instructional techniques, and classroom size can mediate these risk factors. As these factors vary widely, a comprehensive approach is needed to examine the role of these factors. This chapter includes two NEPS analyses that examined teaching styles and the moderating role of self-concept and self-esteem as well as different sets of risk factors. Group work related to better outcomes for second-language learners in mathematics and reading, while discussions were associated with poorer outcomes in mathematics for the same group. In addition, self-concept and self-esteem were shown to mediate the effects of gender, special education needs, and nonverbal reasoning on both reading and mathematics literacy.

The seventh chapter ‘An Illustration of Local Structural Equation Modeling for Longitudinal Data: Examining Differences in Competence Development in Secondary Schools’ by Gabriel Olaru, Alexander Robitzsch, Andrea Hildebrandt and Ulrich Schroeders offers a new approach to study inter-individual differences in educational

development. It describes how a combination of longitudinal and local structural equation modeling (LSEM) can be used to study how students' context influences their growth in educational achievement. LSEM is a nonparametric approach that allows for the moderation of a structural equation model over a continuous variable (e.g., socio-economic status, cultural identity, age). Thus, it does not require the categorization of continuous moderators as applied in multi-group approaches. Unlike regression-based approaches, it does not impose a particular functional form (e.g. linear) on mean differences and can reveal differences in variance-covariance structure. LSEM can be used to detect nonlinear moderation effects, to investigate sources of measurement invariance violations, and to study moderation effects on all parameters in the model. The authors show how LSEM can be implemented with longitudinal NEPS data using the R-package *sirt* written by the authors. The chapter examines the impact of parental education on mathematics and reading literacy in secondary school across three measurement time points and compare LSEM with regression-based approaches and confirmatory multi-group factor analysis. The results provide further evidence of the strong influence of the educational background of the family.

The eighth chapter 'Inequality in Educational Transitions During Secondary School: Results From the German National Educational Panel Study' by Florian Wohlkinger and Hartmut Ditton examines the transitions between different types of secondary schools. This so-called 'openness' of the German education system is supposed to enable a correction of misallocated pupils and thereby support children's delayed improvement in academic performance. Both transition directions are feasible: downward movements from upper to lower secondary school form and upward movements from the lower to upper types of secondary school. The aim of this study is to determine whether transitions in secondary schooling show patterns of social selectivity. Using data from the NEPS, the authors provide an overview of the initial distribution of students across different types of secondary schools. They then distinguish different transitions taking into account the initial secondary school type and compare the various subgroups with regard to various influencing factors known to be associated with educational inequalities. The empirical results show that secondary school transitions are related to students' social background and gender even when controlling for performance.

The ninth chapter 'Alternative Routes to Higher Education Eligibility: Inclusion, Diversion, and Social Inequality on the Way to Higher Education' by Steffen Schindler and Felix Bittmann shows that the expansion of alternative pathways leading to an higher education entry certificate, which dates back to the reforms of the 1960s, has been largely ineffective in reducing social inequality in access to higher education. The authors argue that this is partly due to unintended effects of the expansion of alternative pathways that resulted in diversion processes among students from disadvantaged social origin. These diversion effects channel students from disadvantaged background into non-academic secondary school tracks and expose them to learning environments that differ from those of the academic school track. The chapter provides empirical evidence that these learning environments

influence students' educational aspirations and cognitive development in ways that eventually reduce their chances of attaining higher education.

The tenth chapter 'Dropping Out of Higher Education in Germany: Using Retrospective Life Course Data to Determine Dropout Rates and Destinations of Non-completers' by Nicole Tieben disentangles non-completion and dropout of full-time students in higher education using longitudinal NEPS data. The author discusses the methodological challenges of conventional approaches and shows how the advantages of retrospective life course data can be used for higher education research. She examines the destinations of non-completers and dropouts as well as the labour market returns of dropouts, using sequence data analyses and multinomial logistic regressions. The results show that conventional designs possibly are prone to overestimate dropout rates. Longitudinal analyses of post-dropout destinations show that permeability between vocational training and higher education is bidirectional. Vocational training is a relevant absorber of higher education dropouts, but at the same time, vocational qualifications acquired prior to higher education act as safety net buffering labour market risks of dropouts.

The eleventh chapter 'Studying Influences of Socio-economic Contexts and Spatial Effects on Educational Careers' by Steffen Hillmert, Andreas Hartung and Katarina Weßling focusses on the socio-economic and spatial context effects in education. The authors develop concepts and methodological procedures for analysing spatial contexts. They measure the impact of socio-structural contextual characteristics on aspirations and transition opportunities and collect and prepare relevant contextual data. For certain phases of the educational career, the authors are able to demonstrate that contextual settings (neighbourhoods and regional contexts) are relevant for educational inequalities. The research project also shows that the relationship between socio-economic contexts and inequalities in education is complex, and the researchers develop strategies to deal with temporal, spatial, and interpersonal variation in contextual effects on educational attainment.

The twelfth chapter 'Low-Achieving School-Leavers in Germany – Who Are They and Where Do They Go?' by Anne Christine Holtmann, Laura Menze and Heike Solga analyses school-leavers with a lower secondary school leaving certificate or less who are at risk of being left behind. In a first step, the authors compare the parental resources as well as the cognitive and non-cognitive skills of these school-leavers with those with an intermediate school leaving certificate. In a second step, they then investigate whether these low achievers can improve their educational attainment after general school by either catching up on school-leaving qualifications or starting vocational training. In a third step, the authors analyse transitions from school to vocational education by conducting a sequence analysis. Based on NEPS data, they show that low-achieving school-leavers are on average not as well equipped with agency and social resources as other groups but that they represent a rather heterogeneous group. Many of these school-leavers have similar cognitive and non-cognitive skills as school-leavers with an intermediate school leaving certificate, who usually succeed in entering vocational training. However, this potential often remains undiscovered because a considerable proportion of low-achievers does not improve their school certificates and are unable to enter

vocational training even several years after leaving school. The authors also show that transition patterns vary by school type, with pupils from special needs schools being particularly disadvantaged compared to pupils from regular schools.

The thirteenth chapter ‘Occupational Sex Segregation and its Consequences for the (Re-)Production of Gender Inequalities in the German Labour Market’ by Corinna Kleinert, Kathrin Leuze, Ann-Christin Bächmann, Dörthe Gatermann, Anna Erika Hägglund and Kai Rompczyk deals with the occupational link between the educational system and the labour market. In theory, this occupational link is gender-neutral, as both women and men are channelled into jobs according to the occupations for which they are trained. In practice, however, this means that patterns of occupational sex segregation in the education system are perpetuated in the labour market. As a result, occupational sex segregation has a significant impact on women’s and men’s subsequent employment biographies and life courses. In this chapter, the authors examine the relevance of occupational sex segregation for the (re-)production of gender inequalities in the German labour market. More specifically, they examine long-term trends in occupational sex segregation, how occupational sex segregation is linked to other occupational characteristics, how these occupational characteristics translate into gender inequalities regarding non-monetary labour market outcomes, and how these occupational characteristics influence the gender wage gap.

The fourteenth chapter ‘Employment-Related Further Training in a Dynamic Labour Market’ by Silke Anger, Pascal Heß, Simon Janssen and Ute Leber examines the changing demand for skills and knowledge due to the accelerating technological progress and increasing international trade. As a result, workers have had to continuously invest in training to update their skills, if they wanted to avoid long-term negative consequences for their careers. This project uses data from the NEPS adult cohort to investigate how the participation of workers in continuing education evolves in dynamic labour markets exposed to technological change and increasing international trade. The study analyses the relationship between workplace automation and employment-related training and shows that the training participation of workers whose jobs were highly affected by automation was much lower than the training participation of workers whose jobs were less affected. Moreover, the results suggest that employers’ financial support explains most of the training gap. In line with the new training literature, companies are the main driver of training investment.

The fifteenth chapter ‘Regional Factors as Determinants of Employees’ Training Participation’ by Katja Görlitz, Sylvi Rzepka and Marcus Tamm highlights the importance of generally neglected regional factors for training. Regional factors have often been neglected because (both in Germany and abroad) many data sets that contain training information do not include detailed geographical identifiers that would allow a merging of information on the regional level. The regional identifiers of the NEPS adult cohort offer the opportunity to advance research on various regional factors. This chapter summarizes the results of two studies that investigate the relationship between training participation and (a) the local level of competition among firms for workers within specific sectors of the economy and (b) the regional

supply of training measured as the number of firms offering courses or seminars to potential training participants.

The sixteenth chapter ‘Is the First Language a Resource, an Obstacle, or Irrelevant for Language Minority Students’ Education?’ by Aileen Edele, Julian Seuring, Kristin Schotte, Cornelia Kristen and Petra Stanat studies the integration of immigrants and their children in the education system. For this integration, language is generally seen as an important factor. While there is widespread agreement that the language of the country of residence (L2) is crucial for students’ educational success, the importance of the language of the country of origin (L1) is disputed. This chapter takes an interdisciplinary perspective and uses NEPS data. It focusses on the role of the L1 in the educational success of immigrants and their children and examines whether the L1 serves as a resource or a barrier, or whether it is largely irrelevant.

The seventeenth chapter ‘Ethnic Differences in Social Capital Mobilization at the Transition to Vocational Training in Germany’ by Tobias Roth and Markus Weißmann offers an in-depth analysis of the differences between students with and without a migration background in Germany in mobilising social capital during the transition to vocational education and training after lower secondary education. In addition to retrospective information, the authors also analyse (hypothetical) prospective information. They also distinguish between different types of social contacts and support. Using data from the first five waves of NEPS Starting Cohort 4, the authors find that students rely heavily on their social contacts, with parents playing the most important role. In terms of general information and support, they find only small ethnic differences in the mobilization of non-institutional social contacts. In contrast, adolescents with a migration background tend to receive less specific support from relatives outside the nuclear family and significantly less from parents. The results suggest that the general motivation of non-institutional social contacts to support the transition to vocational training does not differ between natives and migrants, but that the ability of these ties to provide more specific, instrumental support depends on their host-country-specific resources and thus on their migration history.

The eighteenth and final chapter ‘Gendered Occupational Aspirations: A Comparison of Young Native-Born and Turkish Minority Women’ by Manuel Siegert, Tobias Roth and Irena Kogan shows that women with a migration background represent a growing share of the German population, but a disproportionately low share of the total labour force. The authors examine the gender-specific occupational preferences of female adolescents with a Turkish migration background in comparison to adolescents without a migration background and relate these preferences to the young women’s interests, family orientations, normative gender role perceptions, and the socio-economic status of the desired occupation. The results indicate that Turkish girls are less likely to aspire female-dominated occupations than majority native-born girls. Instead, they prefer integrated occupations that tend to be more prestigious and better paid. This could be mainly due to their ambitious career aspirations, as the difference between native and Turkish girls decreases significantly when controlling for career aspirations.

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