Education as a Lifelong Process

2

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Abstract

In modern societies, education has become a lifelong process. This has made the principles of life-course research of utmost significance in empirical education research. As stated by Glen H. Elder, these can be described as: (1) focusing on long-term educational processes over the individual lifespan; (2) considering individual educational pathways within their institutional and social embeddedness (e.g., within not only formal educational institutions but also nonformal/informal contexts such as the family, peer groups, and other social networks); (3) analyzing decision-making processes in education linked to the idea of agency and the idea of plan-making, creative, and self-determining actors; (4) investigating the time structure and timing of educational events and transitions and the consequences they have for the subsequent educational pathways and educational chances; and (5) conceptually differentiating age, cohort, and period effects. This chapter discusses the importance of these five principles for the conception, design, and possibilities for analysis of the German National Educational Panel Study (NEPS). In the context of these principles, we formulate methodological advantages of longitudinal data on educational processes that can be attained within the idea of NEPS. In particular, panel data improve the opportunities to describe trajectories of growth and development over the life course and to study the patterns of causal relationships over longer time spans.

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2.1 Education as a Lifelong Process: Five Theoretical Principles

The preeminent theoretical orientation of the National Educational Panel Study (NEPS) takes a life-course perspective. This has prompted a decisive shift away from how educational researchers have traditionally approached issues of schooling, skills, competence, and attainment. In particular, it redirects attention toward the *processes* of education and competence *development* and links the *changing* social structure to the *unfolding* of human lives. It also serves as a bridge between psychological and sociological perspectives and between individual development and social structure. Thus, the life course provides an excellent framework for studying education at the nexus of social pathways, developmental trajectories, and social change. (Elder et al. 2004) have summarized the following *five general principles of life-course research* (see also Elder and Giele 2009; see, for the perspective of lifespan developmental psychology, Baltes 1990; Baltes et al. 1980).

2.1.1 The Principle of Lifespan Development

The first principle emphasizes the importance of focusing on long-term individual development over the lifespan. Developmental psychologists often work with the notions of *stages, progressions, growth, and evolution* (Dannefer 1984; Lewontin 2000). The resulting emphasis is on *systematic pathways of development (change) over time*. With regard to competence development, there are two major relevant issues that, nonetheless, possess different regularities and mechanisms (OECD 1999): (a) the question *how competencies develop (cumulatively) over the life course*; and (b) the question *how stable are differences among individuals over time* once they have passed the formative phase of early experiences.

Sociological life-course approaches, while incorporating these individual differences and notions of law-like development such as aging, emphasize variability and exogenous influences on the course of development over time that cannot be predicted by focusing solely on enduring individual traits or ontogenetic past experiences. As a result, important aspects of educational careers are time-varying educational contexts that foster or hinder learning and educational progress. The sociological life-course perspective therefore focuses on the emergent properties over the life course based on structural experiences (Sampson and Laub 2004).

For sociologists, education as a *lifelong process* is to a large extent *age-differentiated*, because age and time often formally influence movement through *educational institutions*

during childhood, adolescence, and early adulthood (Settersten 2004). In Germany, elementary and lower secondary educational institutions are strictly age-graded. Educational curricula require the completion of a specific number of hours; courses must be tackled in a specific sequence; and time limits are set for obtaining certificates. However, Germany does have a more *informal age structuring* after the end of compulsory schooling in vocational, tertiary, and further education in which the degree of formal time structuring is not as exacting. Therefore, it is important to examine how individuals regulate their development in the face of "nonnormative" demands of formal institutions after compulsory school, because *individuals must then adopt a more active role* to compensate for the lack of structure.

The movement of individuals through the educational system is a central object of NEPS, both as a phenomenon to be explained and as a determinant of subsequent economic and noneconomic outcomes throughout the life course. The concept of the *career* can be used to refer to an individual's sequence of roles. Kerckhoff et al. (1996) have proposed treating the concept of *educational career* as being synonymous with *educational trajectory*. The conceptual tool of trajectory encompasses both *sequences of different qualitative states* and *continuous increases or decreases in quantitative characteristics* such as competence development or skill trajectory. Careers can be distinguished from *career lines*, a sequence of educational positions common to the experience of many individuals (Spenner et al. 1982). Educational career lines often depend strongly on *structural features of the educational systems*, and thus draw attention to the ways in which opportunity structures shape the educational careers of individuals (Spilerman 1977). Educational career lines can be viewed as a *flow chart* in which previous decisions and experiences can influence subsequent decisions and experiences, and various pathways can have different consequences in terms of competence development. The term *pathway* is defined here as being identical to career line. There is also a need to *detect single and multiple risks* associated with these pathways.

The educational systems of modern societies intentionally sort students into differing positions whether within schools, between schools, or both. Natriello (1994) discusses *tracking*, *ability grouping*, *age grouping*, and *interest grouping* as the most common within-school stratification mechanisms in modern societies. These mechanisms structure educational career lines by opening up some doors and closing others. NEPS promises a rich account of educational trajectories, largely because students' positions are measured at multiple points over time. NEPS thereby traces trajectories of individuals from early childhood to Kindergarten, to elementary school, to lower and upper secondary school, to postsecondary schooling (which includes vocational education and training, university education, further education, and on-the-job training), to entry into the labor market, to later job careers, and into new activities after retirement.

Life-course research shows that the *events* and *states* of earlier educational stages often have consequences for later educational processes and outcomes (Mayer and Tuma 1990). Dannefer (1987) introduced the so-called *Matthew effect* into the literature on the life course. The Matthew effect means that initial educational inequalities become

magnified over the lifespan. Thus, there seems to be a logic in educational careers that the "already educated get even more education" and the "poorly educated get poorer." The Matthew effect is sometimes also referred to as the *cumulative disadvantage/ advantage hypothesis* (O'Rand and Henretta 1999). It offers a cumulative explanation of how intracohort inequality is engendered in the life course. This effect seems to be particularly important in the case of further education. The literature also reveals the hypotheses of *"status maintenance"* and *"status leveling."* The first hypothesis contends that initial educational inequalities are carried along as individuals move through the life course (Pallas 2002). The second one points to the possibility of a narrowing of the inequality gap (O'Rand and Henretta 1999). Educational research has paid relatively little attention to the challenges of describing and explaining long-term educational trajectories, because longitudinal data have rarely been available over longer time spans.

Finally, the life-course perspective implies that *educational careers should not be studied in isolation from events in other domains of life at the level of the individual*, because most life domains are interdependent in complex ways (Mayer and Tuma 1990). For example, young people often combine their participation in schooling with other activities such as working; others, in contrast, leave and reenter the school system multiple times.

2.1.2 The Principle of Linked Lives

The second principle of life-course research concerns the *interdependence of lives over time*, especially in the family where individuals are linked across generations by bonds of kinship and processes of intergenerational transmission (Moen and Hernandez 2009). NEPS examines long-term relationships between parents and children and how these relationships influence the educational careers of children, adolescents, and adults over the life course. NEPS also covers the role of social networks such as peers, because an individual's beliefs and decisions are molded in interactions with others. Finally, NEPS can analyze the role of an adult's own family change (single, living in consensual or marital unions, the birth of a child, etc.) on her or his participation in further education over the life course.

In contrast to an age-based perspective emphasizing aging and educational careers, a *kin-based perspective on the life course* focuses on families and the ways societies reproduce themselves across generations. Modern educational research merges these two models. For example, Mare (1980) has conceptualized educational attainment as movement through an *ordered sequence of educational transitions*. He argues that educational attainment can be modeled as a set of ordered school continuation probabilities depicting the probability of attaining a given level of schooling as being conditional on having completed the level immediately preceding it. These conditional probabilities are then modeled as a function of individuals' *social backgrounds* and birth cohort membership. Mare's logistic regression estimates reveal that within cohorts, social background is very

important at the beginning of the educational career, but its effects on educational transitions decline from earlier to later transitions. Shavit and Blossfeld (1993) used Mare's model in their comparative study, and found similar declining effects of family background on successive educational transitions over the life course for a broad selection of modern societies.

Cameron and Heckman (1998) have criticized Mare's model on at least two grounds: First, they demonstrated that the empirical pattern of declining social background effects across successive educational transitions depends on arbitrary assumptions about the nature of the selection bias stemming from unobserved heterogeneity in the data. NEPS can add empirical evidence to this discussion, because it *measures variables such as domain-general and domain-specific cognitive competencies*. Cameron and Heckman (1998) have also suggested that individuals do not just concentrate on the next respective educational transition in their *educational decision making*, but choose the ultimate level of schooling that maximizes their net returns to schooling, and that all of the successive transitions are governed by this more *long-term view*. Finally, Breen and Jonsson (2000) have raised the criticism that Mare's (1980) binary sequence decision model fails to represent the more differentiated pathways of European educational systems. NEPS is able to address these issues and provide better empirical evidence with which to decide between these competing models.

The life-course perspective of "linked lives" also refers to *important relationships outside the family*. These include the interactional influences of institutions such as Kindergarten and school, neighborhoods, and peers. *Kindergarten and school* are the first educational organizations that children experience, and they constitute a large part of most children's lives. They are the school setting in which knowledge and competencies are constantly tested, evaluated, and *compared with other students*, and in which children develop a sense of their intellectual efficacy. Research has demonstrated that conceptions of *self-efficacy formed early in life* tend to become self-fulfilling prophecies by either encouraging or discouraging students from taking risks and undertaking new and challenging tasks (Marsh et al. 2006). Schools also provide favorable circumstances for the *emergence of peer groups*. Bandura (1997) observed that, because of similarities in age and experiences, peers provide the most relevant reference group in late childhood and adolescence. Interacting with these peers has a wide range of consequences for children's self-concept and self-efficacy.

2.1.3 The Principle of Agency

The third principle guiding NEPS concerns *agency in human development* and the idea that *planfulness and intention* can affect life-course processes and outcomes. From a psychologist's perspective, the self is at the core of human agency. Bandura's (1982) sociocognitive theory of self-efficacy views individuals not simply as reactive creatures shaped by external events, but as being *agentic, self-regulating, creative, and proactive*.

Self-efficacy refers to the perception of oneself as a causal agent in one's environment. Such beliefs are a major basis of action and interaction over the life course. *Individuals* are active agents in the construction of their lives and *make choices* within the constraints of institutional and sociohistorical structures.

In sociology, the idea of agency is closely related to the so-called *theories of methodological individualism and rational action theory*—that is, theories that the macrolevel aggregates of educational inequality have to be reconstructed via the educational and occupational choices that individuals make under certain constraints in the life course. This is a point that Breen and Goldthorpe (1997) as well as Erikson and Jonsson (1996) have addressed very clearly. These authors try to understand why class differentials in educational participation rates persist even in the face of educational expansion. Drawing on *rational action theory*, they have developed models of educational decisions. These *micro–macro models* provide important conceptual tools for understanding how individuals might incorporate the risk of failure along with beliefs about what kind of choices are possible when performing a rational calculation of costs and benefits.

2.1.4   The Principle of Timing of Events and Transitions

The fourth principle of the life-course perspective emphasizes that developmental consequences of life transitions, events, and behavioral patterns vary according to their timing in a person's life. It recognizes that the impact of life events is contingent on when they occur in an individual's life. There is a need to detect single and multiple risks associated with these pathways. For example, Blossfeld (1990) has shown that the institutions of the educational system in Germany produce "vulnerable" and "less vulnerable" phases in the educational career. These phases result from the educational system's use of age as an organizing principle, and the fact that the educational system consists of different types of institutions. Educational transition decisions are hard to revise once they have been made in Germany. The most "vulnerable" phases in an educational career in Germany are (a) timing of entry into the school system; (b) the period of transition to secondary school (the *Hauptschule*, the *Realschule*, or the *Gymnasium*); (c) the period of transition from secondary school to vocational education and training, university, or the employment system; and (d) the periods of transition within the different types of vocational education and training.

2.1.5   The Principle of Time and Place

The fifth principle of time and place states that the educational careers of individuals are embedded and shaped by the very specific historical times and places they experience in their life courses. During the last decades, life-course research has demonstrated the necessity of *nesting individual lives in 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 as they get older due to some combination of biological, psychological, or social mechanisms. The *period effect* means that—independent of their specific phases in the life course—all individuals are influenced by the same contemporary historical conditions in similar ways. Finally, the *cohort effect* refers to a persisting change across successive (birth) cohorts as specific groups of individuals experience different historical conditions at certain critical periods or transitions in the life course (e.g., changing transition rules that create increasing/decreasing opportunities at crucial educational transitions, or changing labor market conditions at the time of entry into the vocational education and training system). The *cohort sequential design* of NEPS, which follows repeated cohorts over longer time spans of their lives, delivers an appropriate way to identify age, period, and cohort effects (Schaie 1996). In addition, modern *multilevel modeling techniques* allow researchers to specify the complexities of time and environments more accurately for educational processes.

2.2   Methodological Advantages of Longitudinal Data on Educational Processes

Nowadays, there is widespread consensus that if researchers want to rigorously address the types of questions that drive and are central to life-course-oriented educational research, it is essential to use panel data with the methodological advantages they provide (Halaby 2004). In particular, panel data increase the opportunities for describing trajectories of growth and development over the life course and studying the patterns of causal relationships over longer time spans. The strengths of panel data are particularly evident when compared with the commonly collected cross-sectional data (Blossfeld 2009).

2.2.1   Charting Trajectories of Change and Development on the Individual Level

In Germany, most empirical evidence in educational research is still *cross-sectional* (e.g., the Programme for International Student Assessment, PISA) and therefore only a *snapshot* of different students at a particular point in their educational careers. Successive snapshots in a series of cross-sectional surveys highlight the changes in the structure as a whole. However, they do not show the changing (and sometimes unchanging) experiences of *individual* students as their educational careers progress. Coleman (1981) has stressed that one must be very cautious when using single cross-sectional observations, because the data often suggest that the process under study is characterized by stability. However, when we study educational careers, *change and development seem to*

be the rule rather than the exception. For example, an educational career consists of the sequence and timing of participation in certain age-graded and institutionally structured educational processes. Panel data, with information on many individuals measured on several occasions spread over time, can be used to describe these *patterns of change* over the life course. They are especially able to trace the *magnitude and regularity of change* across groups defined by different characteristics or by exposure to different life-course experiences. Even if there should be stability in some measures on the individual level, only temporal data can be used to demonstrate whether this stability actually does exist (Tuma and Hannan 1984).

The notions of development and educational career also suggest a focus on the dependencies among the successive states occupied by an individual over time. Educational careers and developmental processes are often *cumulative in nature* (Mayer and Müller 1986; O'Rand 2009). One example is the Matthew effect discussed above that describes *cumulative disadvantage/advantage processes*. There are also *complex layers of selectivity in educational careers* (Cameron and Heckman 1998), which means that there is a strong likelihood that only quite specific individuals will enter specific schools or parts of the educational system over time. Thus, educational research has to take into account the *details of educational histories* as an indispensable factor in *understanding the present time*. In general, cross-sectional data are not very suitable for achieving this goal, because most such datasets provide only sparse retrospective information. In addition, if performance is assessed only at one single point in time, as is the case in the PISA study, it is not clear whether and to what extent these observed competencies are indeed *relevant for the individual's future success* in the educational system or on the labor market. A *prospective panel study* such as the NEPS that follows up individuals over longer periods of time can help to answer this kind of question.

Educational careers in Germany are often structured by *transitions* linked in *career lines*. Every transition implies that one needs at least two observations—one on the original state (at time *t*) and the other on the destination state (at time *t*+1)—to describe the flows of individuals at various branching points of the educational system. Educational transitions therefore cannot be studied with cross-sectional data. Panel data offer an excellent opportunity to analyze these transition processes in educational careers over the life course.

In sum, NEPS facilitates the description of the *long-term development of education as a lifetime process* on three dimensions: competence development, educational environments, and educational decision making. NEPS also makes it possible to study *differences between various target groups* such as natives and individuals with a migration background. In particular, NEPS is oversampling *Turkish migrants* and *ethnic Germans from the former Soviet Union* (*Spätaussiedler*). Finally, it considers important forms of *economic* (i.e., job career, employment, income) and *noneconomic returns to education* (health, family formation, reduced crime, political and social participation, and subjective well-being) and links them to the various educational pathways.

2.2.2 Studying Causal Processes

The goal of seeking scientifically based evidence for causal relationships in educational research raises methodological design questions such as which inference model is appropriate to specify the relationship between cause and effect and which data and statistical procedures can be used to determine the strength of that relationship (Schneider et al. 2007). Over the last three decades, two different models of causal inference have dominated the work of practitioners in educational research: (a) *causation as robust dependence* and (b) *causation as consequential manipulation.* Recently, Cox (1990, 1992) has proposed a third understanding of *causation as generative process*, and this seems to be particularly relevant for a more systematic and theoretically grounded life-course perspective.

The "*causation as robust dependence*" approach—which, in multiple regression, is known as the "control-variable" approach (Blalock 1970)—is often applied in cross-sectional studies. The advocates of this approach call *X* a "genuine" cause of *Y* insofar as the dependence of *Y* on *X* cannot be eliminated by introducing additional variables into the statistical analysis. Thus, in this approach, causation is established essentially through the elimination of spurious (or noncausal) influences. Although this approach has dominated the social sciences for several decades, nowadays, it is clearly considered to be too limited. In particular, when cross-sectional data are used, a major problem is that these data cannot *establish the time order of cause and effect variables*. Therefore, the researcher has to make strong assumptions about the direction of causality. Second, because *scientists rarely know all the causes of observed effects* or how they relate to one another, it is impossible to be sure that all other important variables actually have been controlled (Shadish et al. 2002). Based on this model, a variable *X* can therefore never be regarded as having causal significance for *Y* in anything more than a provisional sense (Goldthorpe 2001).

The second understanding of *causation as consequential manipulation* seems to have emerged as a reaction to the limitations of *causation as robust dependence*. Instead of "establishing the causes of effects," Holland (1986, 1988) and Rubin (1974, 1978, 1980) are concerned with "establishing the effects of causes." They make clear that it is more to the point to take causes simply as given, and to concentrate on the question of how their effects can be measured securely. According to this approach, causes can be only those factors that could serve as *treatments or interventions in well-designed controlled experiments or quasi-experiments*.

However, in the educational sciences, the situation in which causal inferences have to be drawn is often complex and complicated. In many situations, randomization is practically or ethically unacceptable. In addition, strict experimental controls are often hard to apply. Thus, well-designed randomized controlled experiments or quasi-experiments can be applied only rarely by life-course researchers, and most causal inference must be based on nonexperimental observations of social processes.

2.2.3   NEPS Can Take Advantage of "Natural Experiments"

Of course, a panel design such as NEPS can take advantage of *"natural experiments"* in the educational system. In Germany, responsibility for general and vocational schools and universities lies in the hands of the various federal state (*Bundesländer*) governments. Thus, policy implementations of reforms in the educational system often vary between *Bundesländer*. For example, if the opportunity for parents to decide about their children's type of school at the end of elementary school has been abolished in some *Bundesländer*, one can observe whether the relationship between parents' socioeconomic position and school choice varies between before versus after this reform and between reforming versus nonreforming states (difference-in-difference analysis). Therefore, the impact of educational reforms can be studied as a kind of *"natural treatment effect,"* and evidence from different timepoints can serve to improve the evaluation or planning of policies that intervene in the process in order to promote beneficial outcomes or prevent adverse ones.

2.2.4   Techniques to Approximate Randomized Controlled Experiments Using Observational Data

Because observational data are often highly selective, Rubin (1980) and Holland (1986, 1988) have recommended that social scientists should make the process of unit assignment itself a prime concern of inquiry in their empirical work. A whole battery of statistical techniques has been developed to help to approximate randomized controlled experiments with observational data (Schneider et al. 2007). These methods include *fixed-effects models* (i.e., the adjustment for fixed, unobserved individual characteristics), *instrumental variables* (i.e., a method to correct for omitted variables bias due to unobserved characteristics), *propensity score matching* (an approach in which individuals are matched on the basis of their observed aggregate characteristics), and *regression discontinuity designs* (in which samples and comparisons between groups are restricted to individuals who fall just above or just below a specific cutoff point and, at the same time, are likely to be similar on a set of unobserved variables).

   The panel design of NEPS is particularly strong in dealing with the threats of unit heterogeneity and temporal instability (Allison 1994; Halaby 2004; Hsiao 1986; Maddala 1987). *Unit heterogeneity* means that the units compared are different and, hence, heterogeneous with respect to *stable unobserved properties* that may confound the attribution of effect to the causal variable. Because, in panel studies, the same units are observed at different times, many *unobserved properties* remain *stable* and, hence, can be ruled out as explanations of change in the response variable by so-called *"fixed-effects" or "difference-in-difference"* estimators. *Temporal instability* means that over time, *changes in unobserved exogenous variables* offer alternative explanations for researchers interested in assessing how *changes* in explanatory variables bring about *changes* in a response

variable. *Temporal stability that comes with observing different units at the same time* can be exploited to deal with temporal instability in unobserved influences that threaten inferences from longitudinal data. In addition to these unobserved heterogeneity models, the effects of time-varying and time-invariant explanatory variables on the time trajectory of a response variable can be estimated in *growth models* (McArdle and Epstein 1987; Willet and Sayer 1994). A major attraction of *multilevel* (Goldstein 1995) and *hierarchical models* (see Snijders and Bosker 1999) is the very flexible estimation of growth trajectories that life-course researchers might well find useful.

2.2.5 Causation as Generative Process

A serious issue for the social scientist arises from the insistence of the exponents of the *causation-as-consequential-manipulation* approach that causes must be manipulable (by an experimenter or intervener—at least in principle) (e.g., Holland 1986). The idea is that once the treatment or intervention is introduced, it will quasi-automatically lead to an outcome. The units of analysis in the social sciences—the individuals—are therefore assumed to be passive subjects whose behavior is explained only by causal factors, and their "objectives, knowledge, reasoning and decisions have no further relevance" (Goldthorpe 2001, p. 8). This understanding of causation clearly reduces the testability of relevant theories and models in the social sciences. In particular, it does not seem to be compatible with the microfoundation of modern sociological theory in which actors are considered to have agency, individuals have objectives and knowledge, and, when faced with a choice between different courses of action, they make decisions. Thus, the *causation-as-consequential-manipulation* approach has a limited bearing for social scientists who have moved on conceptually from so-called factor-based to so-called actor-based models (Macy 1991; Macy and Willer 2002).

These issues lead us to the third understanding of *causation as generative process*. According to Cox (1990, 1992), one crucial precondition for claiming a causal link is for there to be an elaboration of an underlying generative process that exists in time and space. A causal association between *X* and *Y* must be considered as being produced by a process and being created by some (substantive) mechanism. A major shortcoming of the approaches of *causation as robust dependence* and *causation as consequential manipulation* is that no explicit notion of an underlying generative process is present in these models. Thus, *causation as generative process* seems to be a necessary expansion of these two understandings of causation.

According to *causation as generative process*, it is important to realize that the role of time in causal explanations does not just lie in specifying a temporal order in which the effect follows the cause in time. It additionally implies that there is a *temporal interval between the causal event and the effect event*. That is, it takes some finite amount of time for the cause to produce a detectable effect. For example, when a student enters a new school, it will take some time before any effect at all can be observed on her or his

competence level. This time interval may be very short or very long, but can never be zero or infinite (Kelly and McGrath 1988). In some causal relationships, effects occur almost instantaneously. In other cases, effects imply lengthy *time lags* between the causal event and the appearance of an effect that must be specified and modeled in an appropriate causal analysis. In current cross-sectional analyses in educational research, this interval between causal and effect events is simply left unconsidered and unspecified. Only temporal data allows the researcher to address and model such temporal lags.

In addition to the question regarding the length of the lag between the timing of the cause and the beginning of the unfolding of the effect, there might also be *different patterns by which the causal effect develops over time*. It is rarely the case that the effect is time-constant. For example, the development of students' competencies in a new school environment is likely to increase nonlinearly over time. However, if the causal effect increases or decreases monotonically or linearly over time, oscillates in cycles, or shows any other complicated time-related pattern, then the strength of the observed (cross-sectional) effect is dependent on the timing of the observation. That is, if only a cross-sectional observation is used, there is a great danger of misspecification. Only time-related data allow the identification of time-related effect patterns in educational careers and their association with other important life-course conditions (family background, income, institutional structure of the educational system, school environment, peer groups, regional context, health, marital status, etc.).

2.2.6 Studying Educational Processes Within Contexts

Contemporary educational theories in sociology, economics, or psychology emphasize individual change and its institutional and historical contexts. *Context effects* exist at different aggregation levels and refer to situations in which changes in the group context themselves influence the dependent variable. Understanding change in educational pathways therefore requires not only time-related data at the individual level but also time-related context information. This information tells us about the growth and decline of personal components under different environmental conditions. Temporal data are much better suited than cross-sectional data to identify such influences at different aggregation levels.

Contexts as causal forces are best studied with longitudinal data. Educational research has to specify in detail the causal mechanisms that link educational contexts (family, peers, community, workplaces, schools, and universities) with educational outcomes over the life course (an early example is the classic study by Coleman et al. 1966). In Bronfenbrenner's ecology of human development, it is the individual's day-to-day routines and activities, "the objectives to which he responds or the people with whom he interacts on the face-to-face basis" (Bronfenbrenner 1979, p. 7) that have a direct influence on her or his development. Few studies have sought to *disentangle the simultaneous effects of contextual and individual factors with longitudinal data*. However, developmental

outcomes are likely to be a result of the interaction between individuals and their environment (Magnusson and Törestad 1992). One can suppose that the impact of the context is stronger at the point in time when a particular developing characteristic undergoes its most rapid development (e.g., Earls and Carlson 1995). As a result of increasing agency through childhood and adolescence, it is further likely that individuals become generally more active and selective in relation to their learning environments, and therefore gradually enhance their potential to influence their own course of educational development. The strengths of the *impact of context* on the individual educational career may therefore be *dependent on the phase of the life course*. More recent developments in *multilevel statistical methods* allow the inclusion of more systematic social observations of contexts as well as individual histories of contexts.

Based on cross-sectional analysis, it is sometimes believed that the effects of context on educational outcomes are weak in terms of the proportion of variance "explained." However, from a longitudinal point of view, there are several reasons why this inference based on cross-sectional evidence could be false (Wikström and Sampson 2003): First, *cross-sectional variance components are only descriptive statistics* that reflect observed distributions at a certain point in time rather than a causal effect. Second, what appears as an *individual characteristic* (e.g., competence level) at one point in time may, at least partly, be an *outcome of earlier context influences (e.g., school type) on the development of the particular characteristic.* One can argue that the context in which the individual grows up is more or less likely to have influenced the development of all individual characteristics relevant for educational outcomes. It is therefore important to *trace not only the individual characteristics over time but also the changes in educational contexts*. Third, in comparison with measures of individual characteristics, context measures are generally crude and less well developed. NEPS contributes to improving this situation.

2.2.7 Studying the Effects of Age Versus Stage

Finally, longitudinal studies are able to show whether competence development is related more to *age or to the respective stage in the educational system*; that is, to ask whether the competence level of a student is explained by the fact that she or he has a certain age (say age 15) or is attending a certain grade (say 9th grade) in school. The relationship between age and the stages in the educational system may also change over the educational career and over historical time. However, cohort effects can be detected in NEPS only if successive cohorts are observed over a longer period. For example, *cohort effects* could be derived from the size of a birth cohort of students competing for a place at the *Gymnasium* or in the vocational education and training system, or they may be caused by specific educational reforms (the amalgamation of *Hauptschule* and *Realschule*). Some effects can also impact on all students over a certain period of time. This would be the case if the publication of the results of a large-scale student assessment study leads (temporarily) to greater efforts on behalf of students and teachers at all stages of education.

In summary, given the rising importance of education as a lifelong process embracing all life domains, there is a huge demand for panel data and high-quality longitudinal educational research in Germany. In particular, there is a clear need for both analytical and methodological progress in order to *understand educational decisions, the role of educational contexts connected to various pathways and competence development through the life course, and how these work together to produce different outcomes*. Educational participation and processes are embedded in various *life-course-specific formal, and nonformal/informal* learning environments, and they are influenced by specific historical times. Available multipurpose panel studies such as, for example, the German Socio-Economic Panel Study (SOEP) and the German Family Panel have severe limitations for the study of education as an on-going process. In particular, they provide only small numbers of observations for specific groups of individuals at various educational branching points, they do not measure competence development over the life course, they lack information covering the educational decision process, and they provide only a partial cover of various educational environments. NEPS as a *nationally representative theme-specific research instrument* makes a big step forward in this direction, because it places education over the life course at the center of the panel. It creates a sound *scientific evidence base* with which a broad range of basic and applied questions can be addressed in the field of education that also allow us to inform policymaking. In particular, NEPS can significantly improve the database for the biennial National Educational Report commissioned jointly by the Standing Conference of the Ministers of Education and Cultural Affairs of the Bundesländer in the Federal Republic of Germany (KMK) and the Federal Ministry of Education and Research (BMBF).

Finally, key variables are defined and measured in a way that *makes it easy to link NEPS to other relevant datasets*. Examples of such datasets include the educational databases of the Official Statistical Office, process-produced employment data of the Federal Employment Agency, the Socio-Economic Panel Study (SOEP), or the various national and international assessment studies such as the Third International Mathematics and Science Study (TIMSS), the Progress in International Literacy Study (PIRLS), the Programme for International Student Assessment (PISA), the Programme for the International Assessment of Adult Competencies (PIAAC), or the Adult Literacy and Lifeskills Survey (ALL). Harmonization of measurements is also sought with regard to the models of student competencies as specified in the national educational standards developed by the Institute for Development of Quality in the Training System (IQB) in Berlin.

2.3   Conclusion

NEPS takes a life-course perspective and refers to the five principles formulated by Glen H. Elder et al. (2004). With its specially developed longitudinal design (see Chap. 1, this volume), NEPS is able to describe individual growth and development from birth to retirement on a very detailed level, thereby providing a huge research potential for scientists

working in the different disciplines with an interest in education as a lifelong process. We have now come a long way from the traditional approach, and we are beginning to see that NEPS is able to make its own considerable contribution to the methodological and theoretical debate about educational processes and competence development over the life course.

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