



Education Processes in Life-Course-Specific Learning Environments

5

Thomas Bäumer, Eckhard Klieme, Susanne Kuger, Kai Maaz,
Hans-Günther Roßbach, Ludwig Stecher and Olaf Struck

Abstract

Pillar 2 of the German National Educational Panel Study (NEPS) conceptualizes and operationalizes the learning opportunities individuals experience throughout their lives. These learning opportunities can occur in different formal, nonformal, informal, and familial learning environments. NEPS is tapping them both quantitatively and

T. Bäumer (✉)

Leibniz Institute for Educational Trajectories, Bamberg, Germany

E-Mail: thomas.baeumer@lifbi.de

E. Klieme

German Institute of International Educational Research (DIPF), Frankfurt, Germany

E-Mail: klieme@dipf.de

S. Kuger

German Youth Institute (DJI), Munich, Germany

E-Mail: kuger@dji.de

K. Maaz

German Institute of International Educational Research (DIPF), Berlin, Germany

E-Mail: maaz@dipf.de

H.-G. Roßbach · O. Struck

University of Bamberg, Bamberg, Germany

E-Mail: hans-guenther.rossbach@uni-bamberg.de

O. Struck

E-Mail: olaf.struck@uni-bamberg.de

L. Stecher

University of Giessen, Gießen, Germany

E-Mail: Ludwig.Stecher@erziehung.uni-giessen.de

qualitatively. The quality of learning opportunities is framed within an opportunity-use model to bring together a social-environmental and an individual perspective. The information provided covers what learning opportunities an individual uses, their duration and intensity and—whenever possible—an estimation of their quality. Also, relations and transitions between different learning environments are covered at some critical intersections (e.g., school entry). Whereas NEPS focuses on the individual perspective, it also asks different actors beside the target person to contribute to the assessment of learning environments in specific cohorts and at specific stages. This leads to a comprehensive view of the cumulation of learning experiences and their effects on competence development, educational biographies, and educational decisions.

Keywords

Education · Panel study · Learning Environments · Learning opportunities
Educational quality

5.1 Introduction

During the life course, individuals experience educational processes in a variety of (synchronic or diachronic) formal, nonformal, informal, and familial learning environments. Chronologically, these can be conceived as a succession of different formal learning environments that structure and partly standardize the life course. This is especially true for the formal educational system in which individuals experience at least two compulsory learning environments (elementary school and secondary school). Different educational settings are experienced before and after formal schooling, and transitions between these consecutive learning environments also have to be taken into account. In Germany, many children attend Kindergarten or day care. After general school, individuals may attend vocational education and training, colleges and universities, and also engage in adult learning courses. During adulthood and the course of working life, additional learning environments are experienced that comprise or foster educational processes (e.g., training on the job, private studies, or mass media). Alongside the chronologically consecutive settings, it is also necessary to take synchronic, coexisting learning environments into account. Educational processes take place within a multitude of settings of a nonformal or informal nature such as the nonformal provisions in the youth welfare system or informal learning in youth clubs, from peers, or from the (mass) media. During childhood and early adolescence, participation in out-of-school activities offered by, for example, sports clubs or music schools are also relevant. Moreover, the family has to be considered, not only as a rather general condition and context for educational decisions but also as a learning environment itself. Thus, the surroundings of an individual that need to be considered in the National Educational Panel Study (NEPS) are composed of a complex interwoven network of different synchronic and

chronological settings with different interconnections and transitions between them. In a life-course perspective, the cumulation of experiences in this complex web of learning environments leads to educational outcomes rather than experiences in a single setting. The main research questions NEPS is addressing are: What kind of learning opportunities are experienced by an individual during the life course? What do experiences in different learning environments look like? How are different learning environments related to each other? What kind of cumulative experiences across different learning environments exist? How do specific learning environments and the cumulation of educational experiences across learning environments relate to individual development and educational decisions? How are learning environments influencing educational returns? But conversely, it also asks what does the use of a learning environment depend on?

Pillar 2 tries to introduce two quite unique aspects to NEPS: First, we address a great variety of learning opportunities a person experiences throughout her or his life. These learning opportunities take place in different formal, nonformal, and informal learning environments. Formal settings, in particular, also comprise educational stages that a person passes through during her or his education. Therefore, Pillar 2 works in close cooperation with the NEPS stages. Due to the diversity and multiplicity of learning opportunities, our first task is to capture as much of these experiences as possible. Besides their mere occurrence, we are also surveying the duration and intensity of learning opportunities. To the best of our knowledge, this is the first time in education research that the analysis of learning opportunities tries to incorporate all learning environments and their interrelationships into one comprehensive approach. Our second task is to supplement, wherever possible, these quantitative aspects with an investigation of the quality of these learning opportunities. An innovative approach applies an overall framework model for all kinds of learning environments and learning opportunities.

5.2 Conceptual Perspectives

When considering education processes, one has to account for the interplay of different actors: at a minimum, someone who educates and someone who is educated. Therefore, teaching or instruction and learning are just two sides of the same coin (e.g., Vermunt and Verloop 1999). Nevertheless, until recently, teaching theories and learning theories have been developed relatively unrelated to each other. Approaches to learning used today—such as social cognitive theory (Bandura 1986) or social constructivist approaches based on Vygotsky's sociocultural theory (e.g., Reusser 2006)—point out that learning is a socially mediated process. The same is true for theories of teaching and instruction. Here, there has been a shift from teaching as the transmission of knowledge to teaching as the (co-)construction of knowledge (e.g., Wellenreuther 2004). Teaching then takes the form of supplying learning opportunities to the student, who, in turn, has to make use of these experiences. The basic notion of the interplay between learning opportunities and their use has been proposed by Helmut Fend (2006) as a model

that captures the interaction between the learning environment and the individual. The model is nondeterministic and thus aligns with modern, constructivist views on learning. It is also consistent with recent theoretical developments in the psychology of motivation and interests that stress the role of the environment in offering support for autonomy, competence, and social relatedness (Ryan and Deci 2000). Support, however, needs to be perceived and taken up by the learner. From a systems theory point of view, the interplay of opportunities and their use can be understood as describing the exchange between the social-interactive and personal systems that constitute the basic operations of the educational system (Luhmann 2002). Thus, the concept of learning environments or, even more, that of learning opportunities points to the notion that education is always a relation between an actor and her or his (social) environment.

The terms formal, nonformal, and informal are often used to characterize learning, but unfortunately in a rather diffuse way (e.g., Overwien 2005). This is especially true in the case of formal learning, because the organizational issue of certifying an educational outcome is confounded with an individual process of achieving this outcome. It is not learning itself that is formal, nonformal, or informal, but the context in which it takes place. A more appropriate and well-established conceptualization of learning makes use of another distinction: that between intentional and incidental learning (e.g., Reber 1989; Sun et al. 2005). The term informal learning often connotes both forms of learning. Therefore, we propose that the terms formal, nonformal, and informal should not be applied to the learning process itself but to the contexts or environments in which learning takes place (e.g., Rauschenbach 2007). Both intentional and incidental learning can occur in all these different environments.

5.2.1 Diversity of Learning Environments

Education is associated most prominently with formal learning environments, notably schools. As a result, it is not surprising that education research is, for the most part, school research. NEPS Pillar 2 also draws from this research for its conceptualization—as will be seen later. *Formal learning environments* are always bound to a specific form of organization with characteristics such as hierarchical stratification, division of labor, goal directedness, and societal function. In addition, one of their major and distinguishing tasks is the certification of educational outcomes. Therefore, educational careers are governed to a great extent by this eligibility function. Personnel in formal learning environments act in an educationally intentional manner, and learning is also intentional but not self-directed (e.g., Fend 2001). In fact, at least in certain age groups (age 6 to 15 years, or for 9 school years), formal education is compulsory in Germany. Educational processes are highly structured in terms of content, timing, and order of subject matter. This strict analysis of formal learning environments holds especially for schools. However, in university, for example, at least the decision on what to study and, to some extent, also the course of instruction are self-determined. In the interest of stringency,

we sacrifice certification as a constituting element and also denominate learning environments occurring before or after school and university as formal: namely, Kindergarten and firms or other enterprises in which vocational education and training and other forms of adult learning take place. This allows for a conceptualization of educational careers as trajectories through a more or less ordered educational system, starting in Kindergarten and going through elementary, lower, and upper secondary school or vocational education and training up to tertiary and further education. Not incidentally, this succession also comprises the sequence of stages within NEPS (see Chap. 1, this volume). In addition, comprehensive descriptions of the German educational system also take this broader view, accounting for Kindergartens at one end and employers and other providers of lifelong learning at the other (e.g., Cortina et al. 2008).

Nonformal and informal learning environments always accompany formal learning environments but differ markedly in that they are not compulsory but self-imposed. Nonformal learning environments are similar to formal learning environments due to the other-directed organization of learning, whereas learning in informal learning environments is essentially self-directed. Nonformal learning environments are also designated as being there for intentional learning, because their use is based on freedom of choice (Rauschenbach et al. 2004). As said before, it is not always easy to separate intentional and incidental learning processes in informal learning environments (e.g., Dohmen 2001). Nevertheless, to qualify as learning experiences, the individual has to perceive them, at least afterwards, as a learning opportunity. In contrast to formal and nonformal learning environments, the informal learning environment does not necessarily offer these learning opportunities intentionally. But, on the other hand, learning in informal learning environments is always self-directed (e.g., Boekaerts and Minnaert 1999). Also—again in contrast to formal and nonformal learning environments—the roles of teachers and students are not defined in a clear-cut way. Often, individuals learn all by themselves—as is the case for media use. But also in other informal learning environments such as peer groups, the roles of teachers and students are not defined at all or change constantly.

Another informal learning environment is of special interest in NEPS: the family. We treat the *familial learning environment* as a special unit of research, because it has a profound significance for education at least for children and adolescents (e.g., Melhuish et al. 2008). It is also the first and a very long-lasting learning environment that precedes, accompanies, and even outlasts most other learning environments. Certainly, families have long-lasting effects not only on educational outcomes and success but in every realm of life (e.g., Schneewind 2008). NEPS Pillar 2 pays special attention to the family of origin as a learning environment and looks at the efforts parents undertake to foster their children's advancement. Later in life, we also examine the individual's own family as a supportive environment for learning. However, Pillar 3 is responsible for families as a more general context for development and as a decision-making unit for educational choices (see Chap. 6, this volume).

5.2.2 Cumulation of Learning Opportunities

Educational processes take place in many different settings. They are influenced by the conditions of specific learning environments and the cumulation of experiences across different learning environments in the life course. All the aforementioned learning environments have to be considered, because education is more than learning and instruction in formal institutions. The family is usually the first environment in which learning opportunities are offered to a child. From birth onward, children interact with their parents, and there is strong evidence that the home learning environment exerts a profound influence on cognitive and social development (e.g., Bradley et al. 2001). Most children then experience a second learning environment: Kindergarten. From age 3 to 6, they spend a great amount of their time in this setting. Even at this young age, children experience additional learning opportunities of a nonformal or informal kind. This continues through the course of formal schooling, which is certainly the main though not the sole source of learning opportunities in childhood and adolescence. Over the course of life, the individual is confronted with an increasing quantity of learning opportunities. From a biographical perspective, single learning environments then lose relevance for the individual. In our opinion, especially for schools and teachers, this should not be treated as a threat to their effectiveness but as a relief from liability. Formal, nonformal, informal, and familial learning environments thus form a complex web of synchronic as well as chronological learning opportunities. Little is known about their cumulative effects as well as their potential reciprocal, oppositional, or diminishing effects. As well as registering all the learning opportunities experienced, it is also necessary to account for the relations between different learning environments. Again, this holds for both a chronological and a synchronic perspective. In a chronological perspective, it is particularly necessary to consider the transitions between successive formal learning environments. NEPS Pillar 2 is predominantly interested in what these transitions imply for the individual, and what measures the learning environments offer to facilitate the transition. A synchronic perspective has to include the relations of formal learning environments to nonformal and informal learning environments (e.g., use of subsidiary offers) as well as the relation of the family to formal learning environments (e.g., parental involvement).

To map the complex web of learning opportunities, some additional points should be considered: Only some learning opportunities can be surveyed retrospectively. Schooling history is one example. But even in such cases, it is only the mere episodes that can be examined. If one wants to gain a comprehensive picture of other learning opportunities and of some other features of these as well, one can examine only a limited time period. In NEPS, we decided to limit this time period to approximately one year back. Therefore, richer information on learning opportunities is possible only from one year before a single panel wave. This makes it necessary to take a longitudinal perspective and observe different cohorts. A second point is that the quantification of learning opportunities should not stop at documenting their mere occurrence. Whenever possible, we

therefore also assess duration and intensity of the single learning opportunities. Last, as said before, formal learning environments correspond in most cases to the stages of NEPS. Therefore, Pillar 2 focuses on nonformal, informal, and familial learning environments and works on formal learning environments in close cooperation with the stages of the NEPS.

Whereas there are a lot of findings on the effects of the occurrence of learning opportunities, especially in economic research (e.g., Heckman et al. 2010), an additional feature has to be considered: Not only quantitative effects but also the influence of the quality of learning opportunities is of strong significance.

5.2.3 Quality of Learning Opportunities

Over the last few years, educational research has gained a basic understanding of the core factors of learning opportunities (e.g., Hugener et al. 2009; Klieme et al. 2009; Klieme and Rakoczy 2008; Kuger and Klieme 2016; Meyer 2005; Scheerens 2008; Seidel and Shavelson 2007). There is even a lot of shared understanding of these factors across school-based research and research on nonformal and informal, for example, out-of-school activities (e.g., Mahoney et al. 2005; Miller 2003) as well as on all-day provision at school (e.g., Radisch et al. 2008; Stecher et al. 2009). The core factors of learning opportunities apply first of all to the interaction between the teaching and the learning person. Therefore, they are often designated as process quality. Four basic factors (more precisely, three plus one, as will be shown below), which hold in a rather general sense, can be distinguished: *Structure*, as a basic factor of learning opportunities, relates to the arrangement of the educational processes taking place in the learning environment, thus providing, for example, safeness, stability, or clarity of rules to the learner. *Support* is reflected in positive emotional relations to peers and adults in the learning environment, understanding, feedback, support for autonomy and competence, and social embedding. *Challenge* relates to tasks that are not too demanding but also not too simple to be solved by the learner, thus leading her or him to a “zone of proximal development.” Such tasks will also be cognitively activating. *Orientation* can be seen in, for example, shared values and norms, coherence among members of the group/organization, and clear expectations. Whereas the first three factors describe the educational processes directly and can therefore be observed straightforwardly, orientation impacts more indirectly by influencing the behavior of the actors in the educational process. In the following, we refer to these four basic dimensions as “SSCO.” Although conceptualized originally in relation to (classroom) instruction, there have been several efforts to describe other learning environments with SSCO as well. Moreover, other conceptualizations have been proposed that we can easily link to the SSCO model. Table 5.1 recapitulates some of these concepts. Because orientation is not always present in other conceptualizations and can be seen as an overarching principle that is related to structure, support, and challenge, please note that it is not included in the table.

Table 5.1 Concepts of educational quality

Learning environment	Structure	Support	Challenge	Reference
Formal: School	Classroom management, clarity and structure	Supportive climate	Cognitive activation and deep content	Klieme et al. (2009)
Formal: School	Classroom instruction and management	Student–teacher social interactions	Student–teacher academic interactions	Wang et al. (1993)
Formal: School	Efficient classroom management	Personal learning support	Cognitively activating elements	Kunter and Baumert (2006)
Formal: Elementary school	Classroom organization	Emotional supports	Instructional supports	Pianta and Hamre (2009)
Nonformal/ Informal: After-school program	Structure/ Organization	Social climate	Focus on skill building and mastery	Mahoney et al. (2007)
General/Formal: Teaching	Regulation function of teaching	Affective function of teaching	Processing function of teaching	Vermunt and Verloop (1999)
General/Formal: Learning	Metacognitive regulation activities	Affective learning strategies	Cognitive processing activities	Vermunt and Verloop (1999)
General: Environments	System maintenance	Relationship	Personal development	Insel and Moos (1974)

Alongside these four basic factors that are proximal to the learning opportunity under consideration, it is also necessary to allow for more distal factors in which the basic factors of process quality are embedded and take the multilayered structure of learning environments into account. For a formal learning environment, SSCO relates basically and especially to the instruction in specific subjects. However, it can also be differentiated on a school level, especially when orientation is considered (e.g., school regulations, social and cognitive climate, achievement expectations). We use Fend's (2006) opportunity–use model of educational quality as refined by Helmke (2007) and Klieme (2006) as a kind of overarching theoretical framework. This depicts not only SSCO but also structural characteristics of the learning environment (e.g., in a classroom setting, the class size, class schedule, or class composition as well as school size or school composition on a broader level). This proximal learning environment itself is embedded within a broader context with, for example, specific socioeconomic compositions. The same conceptualization holds true for the family. The learning opportunities in the familial learning environments—such as in a homework situation—can also be described in terms of the structure, support, and challenge given by parents. These interactions are assumed to be influenced by the parents' educational orientations and further characteristics

(e.g., their general educational level) and the home environment with its structural characteristics (e.g., available books, family income). The family, again, is itself embedded in a regional-local environment and its social networks. The same is true for nonformal and informal learning environments. The interactions between the person receiving learning opportunities (target person) and the person(s) offering them (e.g., music teacher, sports trainer, peers) take place under circumstances that can be described using more structural as well as more contextual features.

In relation to the design of NEPS, we address these differentiated levels of learning opportunities within learning environments. Thus, for each educational setting of focal interest, we consider characteristics contained in the following three dimensions:

- *SSCO*: (a) Structure: safeness, stability, clarity of rules, monitoring, and scaffolding; (b) Support: positive emotional relations to peers and adults, understanding, feedback, support for autonomy, competence, and social embedding; (c) Challenge: demanding tasks, cognitive activation, and adequate pacing; and (d) Orientation: shared values and norms of the actors, coherence among actors, general attitudes and orientations related to educational processes and attitudes toward attributions of academic achievements. These characteristics are proposed to be valid in every educational setting, regardless of its formal versus nonformal or informal set up. Nevertheless, the specific features establishing the basic factors of structure, support, challenge, and orientation will differ between various learning environments. It has to be kept in mind that *SSCO* is also valid on more aggregated levels such as the study program or the school as a whole.
- *Structural characteristics*: Comparatively persistent general conditions for educational processes in the different learning environments. For example, with regard to the learning environment school, the conditions of the class in the general education system: class size and class composition, number of lessons in different subjects according to the class schedule, equipment of the class, education and experience of teachers, and so forth; with regard to the school level: size and structure of the whole school. This scheme can be related easily to nonformal and informal settings such as sports groups. For familial learning environments, similar features can be proposed such as family size, family composition, or time and material resources.
- *Contextual characteristics*: Framing conditions of the learning environment under consideration. For example, with regard to the learning environment school: regional-local characteristics such as urban/rural, unemployment, migration structure, and so forth. For the family, contextual characteristics are treated in more detail in NEPS Pillar 3 (see Chap. 6, this volume).

As proposed in the opportunity–use model, the multilayered characteristics of learning opportunities do not unfold their relevance by themselves, but have to be perceived and used by the individual (as the target person whose educational biography stands at the center of NEPS). Especially for the *perception* of *SSCO*, we expect the frame of

reference to become broader with age. In preschool age, for example, the Kindergarten group seems to be the appropriate learning environment to be explored, whereas in higher education, the study program should be analyzed. The *use* made of learning opportunities may be characterized by constructs such as learning activities or study time. Here, one should bear in mind that outcomes of earlier learning opportunities may also function in the use of later ones. That is to say that competencies and motivation will also influence the use of learning opportunities (see Chaps. 4 and 9, this volume). In addition, these characteristics will become more and more prominent with age. Therefore, the characteristics of the target person in the use of learning opportunities are not at the center of NEPS Pillar 2, but will be treated in some stage-specific survey topics.

The just-mentioned characteristics have been conceptualized mainly within school and teacher effectiveness research. Especially for secondary schooling in general and for math instruction in particular, some major research results are available (e.g., Kunter et al. 2005; Lipowsky et al. 2009) and there are also some for German language instruction (e.g., Klieme et al. 2010). In sum, research shows that challenge is related mainly to competence development and achievement outcomes, whereas support is related to motivation and interest development. Finally, structure as well as orientation seem to serve as a necessary, but not sufficient condition for the quality of education. There is also evidence from research that proximal characteristics influence educational outcomes to a greater extent than more distal ones. Nevertheless, this does not mean that these features are not relevant, especially when taking educational, sociological, and economic perspectives into account. For example, the monitoring of returns to educational inputs and guiding policy in the design of the educational system requires information on the more distal characteristics (see Chap. 8, this volume).

Going back to the succession of formal learning environments in the educational system, research on elementary schools is sparse compared with research on secondary schooling. But results show that the relevant features are much the same as the aforementioned ones (e.g., Helmke and Weinert 1997). Concerning Kindergarten, research conducted so far has relied mainly on global dimensions of educational quality. However, by differentiating structural, orientational, and process quality, the conception strongly resembles the framework of Pillar 2 (e.g., Tietze et al. 2005).

This holds even more when we follow the educational career after compulsory schooling. Whereas there is some information on formal learning environments in higher education and vocational education and training, findings on further education are sparse – maybe due to the fact that occupational settings are seldom treated as formal learning environments. Nevertheless, we conceive these educational settings as offering structure, support, and challenge to the individual and shared educational orientations just like the other formal settings that have been conceptualized more frequently from this perspective.

As noted above, there are hints that our concept of educational quality also holds for nonformal and informal settings (e.g., Mahoney et al. 2007; Miller 2003). This is true for the family as well (e.g., Melhuish et al. 2008; Wild and Gerber 2007).

5.3 Perspectives of Analysis

The basic perspectives of analysis within NEPS Pillar 2 are twofold: They can be conducted on an environmental/institutional level or an individual level.

On the level of learning environments, interest focuses on the quality of single learning opportunities. One can ask how many persons attend different learning environments (e.g., private lessons, music lessons, sport clubs) and how do they rate the quality of education within these learning environments. One can ask how learning environments of the same kind (e.g., secondary schools, Kindergartens) differ, and how do their differences relate to individual development. A wealth of information is being provided on level of the learning environment. This includes structural and contextual characteristics and especially also features of the basic factor “orientation” on the level of the school or Kindergarten. Therefore, through its longitudinal design, the NEPS is also addressing questions concerning the long-term effectiveness of the learning environment and even changes and developments of effectiveness over time (e.g., Klieme and Steinert 2008).

On the level of the individual, we ask about the extent of use and the consequences of different learning opportunities and their cumulation over the life course. Questions are: What learning opportunities are used to what extent, permanence, and intensity? What are the individual and social determinants on which this usage depends? What is the role of the family as a special learning environment? Are there out-of-school educational biographies? Is the perception and evaluation of different learning environments related? Does the use of learning opportunities depend on experiences of their quality or the quality of antecedent learning opportunities? How do amount and quality of learning opportunities relate to competence development? What influence on professional development can be attributed to the learning environment? One unique feature of NEPS is that we can take a look at all the relevant learning environments in the educational biography of the individual in a longitudinal perspective. This is delivering a rich source of data to the scientific community interested in educational research.

5.4 Surveying Learning Environments

After depicting the conceptual frame of NEPS Pillar 2, we now want to show some operationalizations of the aforementioned constructs that are already being implemented. It should be noted that in relation to the living conditions of the actors in particular stages, the focus is on different learning opportunities such as homework or private lessons in the context of students’ familial learning environments; work experiences as learning opportunities at the end of schooling or during university studies; or advanced training courses in further education in adulthood.

Depending on the specific cohort and stage under observation, information on learning opportunities is captured from different actors. Whereas in adult samples, we examine only

the target person's view, in samples of children and adolescents, data is provided by parents as well as educational and administrative staff. The latter give information mainly on contextual, structural, and compositional characteristics of the factual learning environment and also on their educational orientations. Information from parents relates especially to the home and out-of-home learning environments they offer to their children.

A note has to be made on the assessment of SSCO. The process quality of learning opportunities is not easy to grasp. Different perspectives have to be taken into account that all have advantages and disadvantages depending on the dimension under consideration. For process quality of classroom instruction, Clausen (2002) has argued that a comprehensive view necessitates the triangulation of the perspectives of teachers, students, and external observers. In NEPS, an external observation is not feasible—due not only to assessment costs but also to issues of data privacy in scientific use files. Moreover, in some cohorts and for some learning environments (e.g., nonformal and informal learning opportunities) in general, only target persons (i.e., students) are surveyed. On the one hand, students are reliable sources, because they have much more experience with a specific setting than an external observer. On the other hand, however, their evaluations are prone to subjective bias. For example, it is hard to assess challenge independently from one's own competence level. Students also tend to evaluate instruction from a global perspective (e.g., Gruehn 2000). Nevertheless, student achievement correlates more strongly with student self-reports than reports from the teacher's or external observer's perspective. In Kindergarten, children are too young to be surveyed on process quality. Here we have to rely solely on the perspective of their educators.

Another issue is the limited amount of interview time or item numbers within NEPS. We decided primarily to gain a comprehensive picture of the learning opportunities an individual perceives by quantifying their use and complementing this picture whenever possible with some quality aspects. Overall, assessment of quality has to remain quite global. Nevertheless, we have succeeded in capturing quality features for most learning environments under consideration. We shall close with some examples of the corresponding efforts made so far.

A study was conducted to relate process quality in Kindergarten as assessed by trained observers to variables collected in the educator's questionnaire of the NEPS Kindergarten sample (Bäumer and Roßbach 2016). It can be shown that on a global level, Kindergarten quality can be reproduced quite well by the use of questionnaire data. But it has to be stressed that one should not expect to find one single indicator of Kindergarten quality, and any conclusions, especially causal ones, have to be drawn with caution.

In collaboration with NEPS Stage 7 (Higher Education and the Transition to Work; see Chap. 16, this volume), an online survey was conducted targeting the process quality of study programs from the perspective of students. This resulted in the following measurement model of the core factors: Structure is represented by the factors "coordination of courses offered" and "structuredness of lectures and classes." Support comprises "rapport with lecturer," "rapport with fellow students," and "motivation." Challenge is illustrated by "pressure to perform," "meaning orientation," "reproduction orientation," "knowledge

construction” and “knowledge transmission.” Finally, orientation is captured with respect to “research,” “practice,” and “interdisciplinarity” (Schaeper and Weiß 2016).

As a last example, we discuss assessment of the quality of nonformal learning opportunities—for example, practical courses for adolescents during their time at school and courses of further education in adulthood. Here, the battery of questions has to be very short, usually 9 to 10 single items to cover at least three dimensions (structure, support, challenge). Whereas an exploratory analysis resulting in one single principal component showed a tendency toward an overall evaluation, in confirmatory analyses, a multidimensional solution in line with the core factors is usually superior to a single solution.

In the following, we shall give a short overview of the constructs measured and published so far. Because data is provided separately for each of the six NEPS Starting Cohorts (SC) and every SC has a focus on different learning environments, we describe the measurements for the SC individually. Detailed information is available on the NEPS website (www.neps-data.de). Corresponding construct papers are not yet available. They will be published by the end of 2019.

The main focus of *SC 1 Newborns* (see Chap. 11, this volume) with respect to learning opportunities is on parent–child activities. These have been surveyed in all four waves (2012–2015; age of children 0.5 to 3 years) that are available as Scientific Use Files (SUF). There are age-specific versions of the items, with at least one “anchor item” (reading to the child). As a special case, parent–child activities were also assessed by video observation in Waves 1 to 3 (Sommer and Mann 2015), giving additional information on, for example, parental sensitivity and responsivity. Beginning with Wave 2, pedagogical staff in early childhood education and care (ECEC) settings were also surveyed with drop-off questionnaires. Because these instruments are based largely on instruments developed for SC 2, we shall discuss them in the next section.

SC 2 Kindergarten (see Chap. 12, this volume) is an institution-based sample. Therefore, questionnaires for educators and heads of the ECEC facilities are a main focus of Pillar 2. These questionnaires were administered in Waves 1 and 2. In Wave 3, the main sample of target children were enrolled in elementary school. Instruments for teachers and school principals again draw on instruments from SC 3 and will be discussed later. SUF are available from Wave 1 to Wave 6, targeting Grade 4 students (last year of elementary school in Germany). The educators’ and head teachers’ questionnaires contain a wealth of information on structural and compositional characteristics of the ECEC settings and groups of the target children (e.g., group size, opening hours, average age, and age variability of children). Staff characteristics (e.g., years of education, further training) are also included. Process quality is captured in terms of materials and activities offered to the children. The focus of the parent interview is again on parent–child activities and, later, on parental monitoring. Parents are also asked about the out-of-home activities of their children. From Wave 3 onward, school-related variables are also assessed.

Variables related to school are the main focus of *SC 3 Grade 5* (see Chap. 13, this volume). Data for Wave 1 to Wave 7 have been published so far, covering Grade 5 to Grade

10. Parents as well as target students give information on private tuition, parental support of school work, and satisfaction with school. Students also give information on instruction, extracurricular activities at school, and school involvement. However, students also report out-of-school activities such as sports or courses at music or art schools. Questionnaires for teachers cover aspects of instructional quality but also such aspects as teacher attitudes, teamwork, or further education. School principals give information mainly on structural (e.g., school size, facilities) and compositional (teaching staff and students body) characteristics of the school. Every second year (Grade 6, Grade 8, Grade 10), they provide data on all-day school programs at their schools.

The same information is available for *SC 4 Grade 9* (see Chaps. 14 and 15, this volume), as long as target students stay in school. Students leaving school are followed up individually. Information from context persons is no longer available. The SUF for SC 4 comprises nine waves so far. At the first interview, students were asked about support in the transition out of school (into work). In later waves, they were surveyed on the quality of vocational training when they were in last year of training.

As said before, the main focus of Pillar 2 regarding *SC 5 First-Year Students* (see Chap. 16, this volume) is on the process quality of study programs. The corresponding online questionnaires have been conducted in Wave 2 (2011) and Wave 6 (2013/2014). Other online questionnaires provide information on learning groups, university activities, and voluntary activities (Wave 4 and Wave 8). SUFs for Wave 1 to Wave 10 are already available.

The adult sample *SC 6 Adults* (see Chap. 17, this volume) is concerned mainly with further education courses. Besides quantifying these courses, target persons also evaluate their quality. They also give information on more informal learning opportunities. Data on these issues is provided in each of the eight waves published as SUF so far. In addition, information on work tasks (variety of requirements, range of activity) is available for Wave 4 and Wave 8. These not only demand knowledge but also influence informal learning. Data on volunteer activities are available for Wave 6.

To conclude, despite the challenges associated with assessing the core factors of Pillar 2, results have shown that they can be surveyed quite successfully. Moreover, data on the structural and contextual characteristics of the learning environment, which also capture the multitude of learning opportunities itself, provide a rich resource for different analyses by the different academic disciplines conducting education research.

5.5 Outlook

During their educational careers, individuals pass through a variety of formal, nonformal, and informal learning environments. It can be said that the succession of these settings as well as their synchronic structuring mold—at least in part—an individual's educational career. The major advantage, challenge, and innovative potential of NEPS is that it brings together diverse and, in some cases, perhaps conflicting learning environments within a

general framework. The framework we propose describes educational environments as offering learning opportunities that the individual can make use of, and this leads to a cumulation of learning experiences across time and settings. By focusing on the educational quality of the learning opportunities, it becomes possible to examine the educational system and its effects on the individual's educational career as a whole, thereby relating diverse findings to each other and combining them to gain a deeper understanding of the educational processes taking place in Germany.

References

- Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice-Hall.
- Bäumer, T., & Roßbach, H.-G. (2016). Measurement of preschool quality within the National Educational Panel Study – Results from a methodological study. In H.-P. Blossfeld, J. von Maurice, M. Bayer, & J. Skopek (Eds.), *Methodological issues of longitudinal surveys. The example of the National Educational Panel Study* (pp. 543–560). Wiesbaden, Germany: Springer VS.
- Boekaerts, M., & Minnaert, A. (1999). Self-regulation with respect to informal learning. *International Journal of Educational Research*, 31, 533–544.
- Bradley, R. H., Corwyn, R. F., Burchinal, M., McAdoo, H. P., & Coll, C. G. (2001). The home environments of children in the United States Part II: Relations with behavior development through age thirteen. *Child Development*, 72, 1868–1886.
- Clausen, M. (2002). *Qualität von Unterricht – Eine Frage der Perspektive?* Münster, Germany: Waxmann.
- Cortina, K. S., Baumert, J., Leschinsky, A., Mayer, K. U., & Trommer, L. (Eds.). (2008). *Das Bildungswesen in der Bundesrepublik Deutschland: Strukturen und Entwicklungen im Überblick* (2nd ed.). Reinbek bei Hamburg, Germany: Rowohlt.
- Dohmen, G. (2001). *Das informelle Lernen. Die internationale Erschließung einer bisher vernachlässigten Grundform menschlichen Lernens für das lebenslange Lernen aller*. Bonn, Germany: BMBF.
- Fend, H. (2001). *Qualität im Bildungswesen: Schulforschung zu Systembedingungen, Schulprofilen und Lehrerleistung* (2nd ed.). Weinheim, Germany: Juventa.
- Fend, H. (2006). *Neue Theorie der Schule. Einführung in das Verstehen von Bildungssystemen*. Wiesbaden, Germany: VS Verlag für Sozialwissenschaften.
- Gruehn, S. (2000). *Unterricht und schulisches Lernen: Schüler als Quellen der Unterrichtsbeschreibung* (Pädagogische Psychologie und Entwicklungspsychologie: Bd. 12). Münster, Germany: Waxmann.
- Heckman, J. J., Moon, S. H., Pinto, R., Savelyev, P. A., & Yavitz, A. (2010). The rate of return to the HighScope Perry Preschool Program. *Journal of Public Economics*, 94, 114–128.
- Helmke, A. (2007). *Unterrichtsqualität – erfassen, bewerten, verbessern* (5th ed.). Seelze, Germany: Klett.
- Helmke, A. & Weinert, F. E. (1997). Unterrichtsqualität und Leistungsentwicklung: Ergebnisse aus dem SCHOLASTIK-Projekt. In F. E. Weinert & A. Helmke (Eds.), *Entwicklung im Grundschulalter* (pp. 241–251). Weinheim, Germany: Psychologie Verlags Union.
- Hugener, I., Pauli, C., Reusser, K., Lipowsky, F., Rakoczy, K., & Klieme, E. (2009). Teaching patterns and learning quality in Swiss and German mathematics lessons. *Learning and Instruction*, 19, 66–78.

- Insel, P. M., & Moos, R. H. (1974). Psychological environments. Expanding the scope of human ecology. *American Psychologist*, 29, 179–188.
- Klieme, E. (2006). Empirische Unterrichtsforschung: Aktuelle Entwicklungen, theoretische Grundlagen und fachspezifische Befunde. *Zeitschrift für Pädagogik*, 52, 765–773.
- Klieme, E., Pauli, C., & Reusser, K. (2009). The Pythagoras Study – Investigating effects of teaching and learning in Swiss and German mathematics classrooms. In T. Janik & T. Seidel (Eds.), *The power of video studies in investigating teaching and learning in the classroom* (pp. 137–160). Münster, Germany: Waxmann.
- Klieme, E., & Rakoczy, K. (2008). Empirische Unterrichtsforschung und Fachdidaktik. Outcomeorientierte Messung und Prozessqualität des Unterrichts. *Zeitschrift für Pädagogik*, 54, 222–237.
- Klieme, E., & Steinert, B. (2008). Schulentwicklung im Längsschnitt. Ein Forschungsprogramm und erste explorative Analysen. In M. Prenzel & J. Baumert (Eds.), *Vertiefende Analysen zu PISA 2006* (Zeitschrift für Erziehungswissenschaft: Sonderheft 10, pp. 221–238). Wiesbaden, Germany: VS Verlag für Sozialwissenschaften.
- Klieme, E., Steinert, B., & Hochweber, J. (2010). Zur Bedeutung von Schulqualität für Unterricht und Lernergebnisse. In W. Bos, E. Klieme, & O. Köller (Eds.), *Schulische Lerngelegenheiten und Kompetenzentwicklung* (pp. 227–251). Münster, Germany: Waxmann.
- Kuger, S., & Klieme, E. (2016). Dimensions in context assessment. In S. Kuger, E. Klieme, N. Jude, & D. Kaplan (Eds.), *Assessing contexts of learning. An international perspective* (pp. 3–38). Cham, Switzerland: Springer.
- Kunter, M., & Baumert, J. (2006). Who is the expert? Construct and criteria validity of student and teacher ratings of instruction. *Learning Environments Research*, 9, 231–251.
- Kunter, M., Brunner, M., Baumert, J., Klusmann, U., Krauss, S., Blum, W., Jordan, A., & Neubrand, M. (2005). Der Mathematikunterricht der PISA-Schülerinnen und -Schüler: Schulformunterschiede in der Unterrichtsqualität. *Zeitschrift für Erziehungswissenschaft*, 8, 502–520.
- Lipowsky, F., Rakoczy, K., Pauli, C., Drollinger-Vetter, B., Klieme, E., & Reusser, K. (2009). Quality of geometry instruction and its short-term impact on students' understanding of the Pythagorean theorem. *Learning and Instruction*, 19, 527–537.
- Luhmann, N. (2002). *Das Erziehungssystem der Gesellschaft*. Darmstadt, Germany: Wissenschaftliche Buchgesellschaft.
- Mahoney, J. L., Larson, R. W., & Eccles, J. S. (Eds.). (2005). *Organized activities as contexts of development: Extracurricular activities, after-school and community programs*. Mahwah, NJ: Erlbaum.
- Mahoney, J. L., Parente, M. E., & Lord, H. (2007). After-school program engagement: Links to child competence and program quality and content. *Elementary School Journal*, 107, 385–404.
- Melhuish, E. C., Phan, M. B., Sylva, K., Sammons, P., Siraj-Blatchford, I., & Taggart, B. (2008). Effects of the home learning environment and preschool center experience upon literacy and numeracy development in early primary school. *Journal of Social Issues*, 64, 95–114.
- Meyer, H. (Ed.). (2005). *Was ist guter Unterricht?* (3rd ed.). Berlin, Germany: Cornelsen.
- Miller, B. M. (2003). *Critical hours: Afterschool programs and educational success*. Quincy, MA: Nellie Mae Education Foundation. Retrieved September 14, 2010, from http://www.nmefdn.org/uploads/Critical_Hours.pdf
- Overwien, B. (2005). Stichwort: Informelles Lernen. *Zeitschrift für Erziehungswissenschaft*, 8, 339–355.
- Pianta, R. C., & Hamre, B. K. (2009). Conceptualization, measurement, and improvement of classroom process: Standardized observation can leverage capacity. *Educational Researcher*, 38, 109–119.
- Radisch, F., Fischer, N., Stecher, L., & Klieme, E. (2008). Qualität von unterrichtsnahen Angeboten an Ganztagschulen. In T. Coelen & H. U. Otto (Eds.), *Grundbegriffe Ganztagsbildung. Das Handbuch* (pp. 910–917). Wiesbaden, Germany: VS Verlag für Sozialwissenschaften.

- Rauschenbach, T. (2007). Im Schatten der formalen Bildung: Alltagsbildung als Schlüsselfrage der Zukunft. *Diskurs Kindheits- und Jugendforschung*, 2, 439–453.
- Rauschenbach, T., Leu, H. R., Lingenauber, S., Mack, W., Schilling, M., Schneider, K., & Züchner, I. (2004). *Non-formale und informelle Bildung im Kindes- und Jugendalter. Konzeptuelle Grundlagen für einen Nationalen Bildungsbericht* (Bildungsreform Bd. 6). Berlin, Germany: BMBF.
- Reber, A. S. (1989). Implicit learning and tacit knowledge. *Journal of Experimental Psychology: General*, 118, 219–235.
- Reusser, K. (2006). Konstruktivismus – vom epistemologischen Leitbegriff zur Erneuerung der didaktischen Kultur. In M. Baer, M. Fuchs, P. Füglistner, K. Reusser, & H. Wyss (Eds.), *Didaktik auf psychologischer Grundlage. Von Hans Aebli's kognitionspsychologischer Didaktik zur modernen Lehr- und Lernforschung* (pp. 151–168). Bern, Switzerland: h.e.p.
- Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55, 68–78.
- Schaeper, H., & Weiß, T. (2016). The conceptualization, development, and validation of an instrument for measuring the formal learning environment in higher education. In H.-P. Blossfeld, J. von Maurice, M. Bayer, & J. Skopek (Eds.), *Methodological issues of longitudinal surveys. The example of the National Educational Panel Study* (pp. 267–290). Wiesbaden, Germany: Springer VS.
- Scheerens, J. (2008). *Review of research on school and instructional effectiveness*. Enschede, Netherlands: University of Twente. Retrieved September 14, 2010, from http://www.reva-education.eu/download.php?file_url=IMG/pdf/scheerens_report.pdf
- Schneewind, K. A. (2008). Sozialisation und Erziehung im Kontext der Familie. In R. Oerter & L. Montada (Eds.), *Entwicklungspsychologie* (6th ed., pp. 117–145). Weinheim, Germany: Beltz.
- Seidel, T., & Shavelson, R. J. (2007). Teaching effectiveness research in the past decade: The role of theory and research design in disentangling meta-analysis results. *Review of Educational Research*, 77, 454–499.
- Sommer, A., & Mann, D. (2015). *Qualität elterlichen Interaktionsverhaltens. Erfassung von Interaktionen mithilfe der Eltern-Kind-Interaktions Einschätzungsskala im Nationalen Bildungspanel* (NEPS Working Paper No. 56). Bamberg, Germany: Leibniz-Institut für Bildungsverläufe, Nationales Bildungspanel.
- Stecher, L., Klieme, E., Radisch, F., & Fischer, N. (2009). Unterrichts- und Angebotsentwicklung—Kernstücke der Ganztagschulentwicklung. In F. Prüß, S. Kortas, & M. Schöpa (Eds.), *Die Ganztagschule: von der Theorie zur Praxis* (pp. 185–201). Weinheim, Germany: Juventa.
- Sun, R., Slusarz, P., & Terry, C. (2005). The interaction of the explicit and the implicit in skill learning: A dual-process approach. *Psychological Review*, 112, 159–192.
- Tietze, W., Roßbach, H. G., & Grenner, K. (2005). *Kinder von 4 bis 8 Jahren: Zur Qualität der Erziehung und Bildung in Kindergarten, Grundschule und Familie*. Weinheim, Germany: Beltz.
- Vermunt, J. D., & Verloop, N. (1999). Congruence and friction between learning and teaching. *Learning and Instruction*, 9, 257–280.
- Wang, M. C., Haertel, G. D., & Walberg, H. J. (1993). Toward a knowledge base for school learning. *Review of Educational Research*, 63, 249–294.
- Wellenreuther, M. (2004). *Lehren und Lernen – aber wie? Empirisch-experimentelle Forschungen zum Lehren und Lernen im Unterricht* (Grundlagen der Schulpädagogik Bd. 50). Hohengehren, Germany: Schneider.
- Wild, E., & Gerber, J. (2007). Charakteristika und Determinanten der Hausaufgabenpraxis in Deutschland von der vierten bis zur siebten Klassenstufe. *Zeitschrift für Erziehungswissenschaft*, 10, 356–380.