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Educational Processes, Decisions, and the Development of Competencies from Early Preschool Age to Adolescence

Findings from the BiKS Cohort Panel Studies

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The BiKS-Study on "Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age": General Outline of Research Questions and Design of the BiKS-3-18 and the BiKS-8-18 Studies

Jutta von Maurice, Sabine Weinert, Hans-Peter Blossfeld, Cordula Artelt and Hans-Günther Rossbach

Abstract

BiKS is an interdisciplinary longitudinal large-scale study on educational processes, competence development, and the formation of educational decisions. It consists of two panel studies: BiKS-3-18 started in September 2005 with 547 children at age 3 and followed these children till age 18 with 13 panel waves. BiKS-8-18 started in March 2006 with 2,395 students in grade 3 and followed them till age 18 with 11 panel waves. Both samples were drawn in

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selected cities and regions in Bavaria and Hesse (Germany) following a multi-step sampling procedure. Besides individual development of competencies, school-relevant attitudes, and educational decisions, special attention is given to the family, preschool, and school as important learning environments. The instrumentation follows a multi-informant perspective where possible and includes standardized competence tests, questionnaires, and observational methods. Moreover, some subsamples are studied with in-depth qualitative methods. Data are documented and available to the scientific community free of charge. This chapter provides a general introduction to the interdisciplinary research unit BiKS and its main aims. Moreover, it presents an overview of the two longitudinal BiKS studies BiKS-3-18 and BiKS-8-18.

Keywords

Educational trajectories · Longitudinal data · Interdisciplinary research · Preschool · School

1 Introduction: From an Interdisciplinary Research Vision to Widely-Used Datasets

The BiKS project was launched at the University of Bamberg in the early 2000s when an interdisciplinary group of researchers discussed the results of the international large-scale student assessment studies (PISA), which showed that German students' competencies at age 15 were below average and were strongly influenced by disparities of family background. The questions of how children's competencies develop in different learning environments, when differences related to family background emerge, how educational decisions are made, and how families and educational institutions can promote children's competence development and educational trajectories have been addressed by the interdisciplinary group of researchers. Intensive discussions focused on the factors

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influencing child development and educational processes at home, preschool, and school, taking into account a comprehensive range of sociodemographic background parameters as well as the complex interplay of (developmental) characteristics and individual prerequisites of the children in the changing institutional and family contexts over the life course. Large-scale data on children’s educational development were not yet available in the early 2000s in Germany, and these questions remained unanswered. Thus, at the University of Bamberg the decision was made to build a large-scale database on educational processes, competence development, and educational decision-making in order to gain cross-disciplinary insights from it. The idea of a 2-cohort multi-informant multi-methods panel study was born.

Drawing on a bioecological model of child development (e.g., Bronfenbrenner and Morris 2006), the two BiKS studies consider children’s individual prerequisites and trace children’s competence and skill development with a special focus on (a) proximal educational processes in the family and in educational institutions, (b) the formation and impact of educational decisions, and (c) the impact of distal influencing factors such as the socioeconomic status of families (e.g., parental education, occupation, and family income) and state regulations, e.g. regarding entry into primary schools or for choice of school tracks. School tracking starts relatively early in Germany, namely after the 4th grade (when the transition to grade 5 takes place) at around age ten with different regulations among the federal states, e.g., regarding the importance of school grades and parents’ choices (for a chart on the structure of the German education system see Kultusministerkonferenz 2017; see also Blossfeld et al. 2023 for a brief description).

At the same time, the need for more synergies between existing empirical educational research activities in Germany and, in particular, the lack of well-trained young researchers in this field in Germany was discussed at the level of science policy, leading to a call for proposals for research units in empirical educational research by the *German Research Foundation* (DFG; for background information see Deutsche Forschungsgemeinschaft 2002). It included the funding of a professorship to enhance research activities and strengthen productive science locations in empirical educational research.

After submitting a successful application to the DFG, the *research unit BiKS* started its work in 2005. Based on extensive theoretical work and instrument development, data collection in preschools (BiKS-3-18) began in September 2005 and data collection in third grade (BiKS-8-18) started shortly thereafter in March 2006. After an 8-year-funding period within the funding line of DFG research units, a further 3-year-funding was granted by the DFG within the framework of the regular funding scheme to continue the research activities as well as data collection in both BiKS studies. Finally, a further funding of the BiKS-3-18 project (survey wave in 2020) was granted by the Federal Ministry of Education and Research (BMBF).

Data from both BiKS studies were made available to the scientific community from early on as Scientific Use Files[1] (see Weinert et al. 2013, for BiKS-3-18; Artelt et al. 2013, for BiKS-8-18) and results of the BiKS research team are disseminated through numerous publications and national and international careers of team members.

In addition, BiKS proved to be the starting point for some far-reaching structural changes in the field of educational research at the University of Bamberg. Among other things, a chair and a department for empirical educational research as well as an option for a master's program in this field (interdisciplinary master's program) were introduced. Later, BiKS also had an impact on the foundation of the "Bamberg Graduate School of Social Sciences (BAGSS)" and proved to be a focal point for the conceptualization and implementation of the National Educational Panel Study (NEPS; Blossfeld and Rossbach 2019) as a kind of an "adult brother" of BiKS.

2 Research Questions

Based on empirical findings that show an early emergence of educationally relevant individual differences in child development as well as disparities depending on family background and the relevance of both primary and secondary effects of the family on educational careers, future life chances, and social participation, the two BiKS studies were designed to address relevant issues from an interdisciplinary perspective. In particular, the two BiKS studies were designed to analyze educational processes, competence development, and educational decisions combining theories, instruments, and research methods from educational science, psychology, and sociology (see Fig. 1).

[1] Data of the waves 1 to 10 of the BiKS-3-18 study (i.e., from age 3 till age 10: BiKS-3-10) and of the waves 1 to 8 of the BiKS-8-18 study (i.e., from age 8 to age 14: BiKS-8-14) are already available as Scientific Use Files. Data releases on the further waves are in preparation.

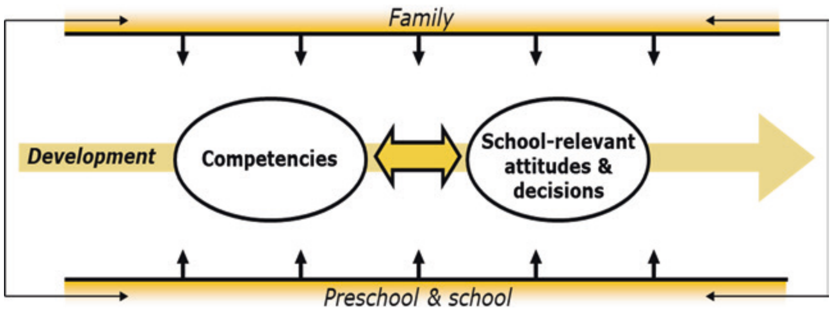

Fig. 1 BiKS as an interdisciplinary endeavour

In addition, BiKS combines a quantitative, large-scale approach with qualitative supplementary projects and with targeted in-depth assessments in smaller subsamples in different projects. With a clear focus on development and the institutional as well as family environment, the underlying mechanisms are thus to be modeled and better understood.

Based on this general approach, the main research projects were carried out addressing a set of research questions structured according to several focal points:

On a first level, BiKS focused on each of the following three main perspectives, i.e., the development of competencies and skills, on factors fostering child development and school performance, as well as on the formation and impact of educational decisions:

(1.1) When and how do educationally relevant competencies or their precursors develop in childhood? How stable or changeable are educationally relevant competencies from an intra- and inter-individual perspective? Which (subgroup-specific) developmental trajectories and relations between developmental domains can be identified?

(1.2) What are the structural features, pedagogical orientations, and process features in educational institutions and in families? How stable or changeable are such environmental features?

(1.3) When and how are educational decisions or decision-related attitudes and orientations related to school enrollment and the transition to secondary education shaped? How stable or changeable are educational decisions and their antecedents?

On a second level, relationships between two of the areas under consideration become relevant, both in a synchronous context and over time:

(2.1) How do children's competencies influence educational decisions of the different actors (preschool and school teachers, parents) and how are these in turn influenced by the decisions?
(2.2) How do characteristics of educational contexts (preschool, school, parental home) strengthen or hinder the development of children's competencies and in what way do these in turn influence, for example, the pedagogical orientations of parents or the staff in preschools and schools?
(2.3) Which characteristics of educational institutions and the family co-vary with educational decisions and how can the relevant mechanisms of action be explained?
(2.4) What are the relationships between characteristics of different environments (i.e., between preschool and family, school and family, and preschool and school) and how do these relationships change over time?

Finally, all three areas are connected on the third level:

(3.1) How do children's prerequisites, preschool environment and the staff employed there, school environment and teaching staff, family environment and parents interact in the development of competencies?
(3.2) What are the relationships between the actors and environments with regard to the design of support processes and how do these affect concrete support efforts or obstacles?
(3.3) Which interactions of actors in the different contexts affect educational decisions in connection with children's level of competence and competence development and in what way?

(adapted from von Maurice et al. 2007, pp. 3–4)

Although data collection, instrumentation, and research on the various topics mentioned above were assigned to and conducted in separate BiKS projects, from a funding perspective, the success of the BiKS endeavor can clearly be attributed to the interdisciplinary collaboration installed from the outset, which resulted in two jointly planned and conducted large-scale longitudinal studies.

3 Two-Cohort Panel Design

Investigating research questions such as those outlined above clearly requires a life course perspective (Baltes 1990; Baltes et al. 1980; Elder and Giele 2009; Elder et al. 2004). In designing the BiKS studies and the data collection, a focus was placed on transitions between different educational institutions. With the goal

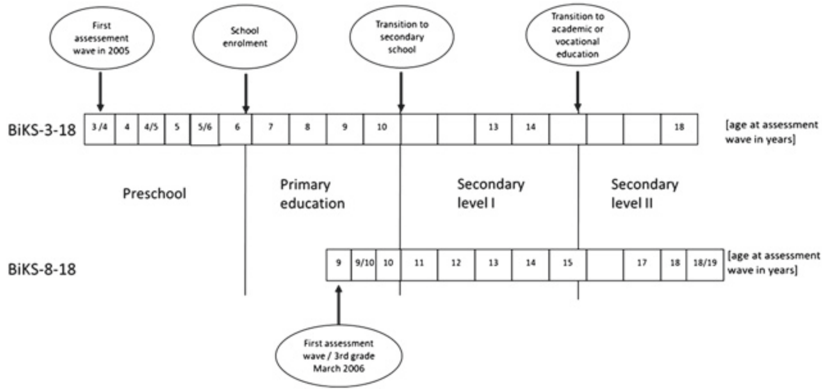

Fig. 2 BiKS as a 2-cohort panel study

of providing results within a reasonable time frame, the decision was made to conduct a *2-cohort panel study* (see Fig. 2).

A first cohort study—*BiKS-3-18*—began at preschool age, three years before regular school enrollment, and followed the children from early preschool through school enrollment, primary, and secondary school and beyond up to age 18. The focus of this cohort study is primarily on children's development from preschool entry to the transition from preschool to primary school and from primary school to the tracked secondary school system and beyond. The entire survey spans 15 years with 13 panel waves, and the learning environments in the family, preschool, and primary school are captured not only through questionnaires but also through observations (for more detailed information concerning BiKS-3-18 see Homuth, Lehrl et al. this volume).

A second cohort study—*BiKS-8-18*—began in third grade and followed adolescents into adulthood, the various educational trajectories including upper secondary education, the vocational and educational training (VET) through early tertiary education, and the labor market through age 18. While the early phases focused on the transition to the tracked secondary school system, the later panel phases focused on the trajectories to upper secondary education or out of the general school system. This panel study covers 10 years with 11 waves (for more detailed information concerning BiKS-3-18 see Homuth, Schmitt and Pfost this volume).

Panel data have many advantages for understanding educational processes and child development as well as the formation of educational decisions compared to cross-sectional data (Blossfeld 2009). Only these data enable the description and modeling of competence and skill development, educational processes, and decision making, as well as the emergence and roots of social disparities. Taking a *life-course perspective* also implies a focus on the different (normative and non-normative) transitions in the respective observational phase. Studies on school enrollment decisions (taking into account socioeconomic and migrant background), decisions for and effects of early or late school enrollment (as opposed to regular enrollment by age), aspects of school readiness and adaptation (or adaptation problems) to the educational system, secondary school form decisions (within two differently organized school systems of the included federal states Bavaria and Hesse), reasons for and effects of class retention and class skipping, school changes, and transitions to the vocational educational system (VET) or to tertiary education are included in the design. This also enables the analysis of interrelationships between different domains of development, influencing factors, their relations and long-term outcomes. Research on children's and adolescents' development and educational trajectories requires detailed data of the children and adolescents themselves—including their perceptions of the family and preschool/school environments—as well as more objective information on the various learning environments. Because individual perceptions can be highly subjective, we adopted a *multi-informant perspective* in designing the BiKS studies. In the BiKS-3-18 study, additional observational approaches were included where possible (see below).

In addition to children and adolescents, parents were included because they represent a learning environment of paramount importance to children and adolescents. They provide not only detailed information on social and migration background, but also their perception of children's and adolescents' competencies, their interactions with the child, the home learning environment, educational values, and their perceptions of the educational institutions. In addition to the family context the institutional context is also very important. Preschool and school teachers (as well as principals) were included in the design. Their perceptions of the child, information about the composition and quality of the institutional contexts, and also characteristics and (assessment) of competencies of teachers were included. Because both samples were drawn within institutions (see below), we were also able to consider the group level in both preschools as well as in primary schools to answer questions about composition and climate variables, particularly in the school context. As already mentioned, the BiKS-3-18 study also included extensive observations in the children's homes, in the preschools, and in the primary schools.

4 Sampling of Children and Adolescents Within Both BiKS-Studies

The sampling of both cohorts BiKS-3-18 and BiKS-8-18 was conducted in several successive steps, which resulted in two connected regionally representative samples (for a detailed description see Homuth, Lehrl et al. this volume; Kurz et al. 2007, for BiKS-3-18; Homuth, Schmitt and Pfost this volume, for BiKS-8-18).

Selection of Federal States

Data collection in BiKS-3-18 and BiKS-8-18 took place in two federal states: Bavaria and Hesse. The two states were selected because they differ in key parameters of the educational system. In particular, in the school system, differences in school enrollment regulations (with differences in the cut-off date for school entry as well as registration deadlines for compulsory schooling), transition to secondary school (with a different role of achieved grades vs. parental preference), and the available types of schools were essential.

Selection of Cities and Regions

In each of the two federal states, one large city, one medium-sized city, and two rural regions were selected. This selection made it possible to cover a high variability of socio-structural contextual factors and opportunity structures in the sample (such as the availability of schools in the respective school types or accessibility). Within Bavaria the large city Nuremberg and the medium-sized city Bamberg as well as the rural districts of Bamberg and Forchheim were selected; Hesse was mapped with Frankfurt am Main as large city, Darmstadt as medium-sized city, and the more rural districts of Odenwald and Bergstraße. These cities and counties differ considerably in terms of area, population, and population density as well as employment structure, unemployment rate, and migrant share, and thus allow for analyses of differences between the two federal states among areas with heterogeneous structural characteristics.

Sampling Procedure for BiKS-3-18

Frame for preschool children: For the sample of preschool children, a sample of institutions was first formed as the primary sampling unit. The sample of preschools for the formation of a panel sample for BiKS-3-18 was based on a sampling frame of 1,018 preschools in eight selected cities and regions mentioned above (379 in Bavaria and 639 in Hesse). Since no other information was available, relevant parameters were collected on these preschools (mainly through a telephone survey from October to February 2005; for most of the Frankfurt preschools, information was provided by the State Board of Education for the City of Frankfurt). Of the 1,018 preschools, valid information could be collected for 983 institutions, e.g., on funding body, institutional size, structure of preschool center, work in self-contained vs. flexible groups, and migrant proportions. As being relevant for the sampling criteria, information was also collected on the number of primary schools that the children in the preschools will usually attend later. This allows a close description of the preschools within the sampling frame.

Sampling and recruiting preschools: Based on the enriched information of the sampling frame, a sample of preschools was drawn in fall 2005 according to specific selection criteria: (1) the sample benchmark of 60.0% Bavarian and 40.0% Hesse institutions was set; (2) the metropolitan areas of Nuremberg and Frankfurt were to be represented by 33.3% of the institutions; (3) within the metropolitan areas of Nuremberg and Frankfurt, one-third were to have a low percentage of migrants (less than 10.0%), one-third were to have a medium migrant percentage (10.0% to 49.9%), and one-third a high percentage of migrants (50.0% and more); (4) the number of groups in the preschools should be proportionally represented; (5) 90.0% of preschools should be closely associated with a primary school (and given the information in the telephone survey that children in their institution generally all attended the same primary school) and 10.0% should be more loosely associated with a primary school (with children typically spread across three or more primary schools at enrollment). Finally, some types of preschools were dropped from the sampling frame (preschools without fixed groups, forest preschools, preschools specialized in inclusion, which were rare in Germany at the time). Of the total of 1,018 preschools in the sampling frame, 688 remained in the reduced sampling frame (with the reduction explained primarily by the 194 preschools that normally send their children to exactly two primary schools). Taking into account the above criteria, the sample was randomly drawn (with a substitute list used if a preschool refused to cooperate). A total of 178 preschools were asked to cooperate, 15 preschools were non-eligible, and 97 preschools agreed, corresponding to a cooperation rate at the preschool level of 59.5% (65.9% in Bavaria and 51.4% in Hesse).

Sampling and recruiting families: Within the sampled preschools, families in a randomly selected preschool group were asked to participate. Only families with children who were regularly enrolled in school during the 2008/2009 school year (defined by a specific birth span) were eligible to participate. A total of 720 families were asked to participate and the participation rate was quite high with 76.0%—corresponding to a panel sample for BiKS-3-18 of 547 children (participation rates in Bavaria 75.1% and in Hesse 77.6%). The parent survey primarily involved the parent who was predominantly responsible for the child's daily life—which was particularly evident among mothers.

Sampling Procedure for BiKS-8-18

Sampling and recruiting schools: Since official information is available, we were able to characterize the 611 schools in the eight selected cities and regions (281 in Bavaria and 330 in Hesse) according to school types as the most important variable for description. However, we did not rely on this sampling frame information only, but additionally aimed to link the sampling to the BiKS-3-18 study by sampling those schools that served as "receiving" primary schools for the preschool institutions of that study. School recruitment began with schools that were named by preschools as "receiving" primary schools. Since not all of these schools were willing to participate, additional schools had to be included in the sampling process. Sampling was conducted according to three main criteria: (1) if possible, the primary school should be one of the "receiving" schools in the BiKS-3-18 preschool sample; (2) the sample benchmark of 60.0% Bavarian and 40.0% Hesse institutions was set; (2) the major cities of Nuremberg and Frankfurt should be represented by 33.3% of the institutions. A total of 189 primary schools were asked to participate, 8 were non-eligible, and 82 schools agreed, corresponding to an overall participation rate of 45.3% (44.0% for Bavaria and 47.7% for Hesse). Linkage to BiKS-3-18 preschools was achieved for 55 out of the 82 participating schools.

Sampling and recruiting families: In the 82 participating primary schools, the class teachers of all third grades were asked to support the study. A total of 155 classes participated (97 in Bavaria and 58 in Hesse); a valid participation rate cannot be given due to limited data. Within the 155 classes, 3,531 families were asked to participate. There are 2,395 adolescents in the final panel sample of the BiKS-8-18 cohort, which corresponds to a participation rate of 67.8% (Bavaria 67.7% and Hesse 68.1%).

Realized Cases at Wave 1 for Both Cohorts: The Base for the Panels

The starting sample of 547 children in BiKS-3-18 and 2,395 adolescents in BiKS-8-18—with roughly equal proportions of boys and girls—provided a solid base for building a long-term panel study. Detailed information on the panel development for BiKS-3-18, with its 13 panel waves, is given by Homuth, Lehrl et al. (this volume) and for BiKS-8-18, with its 11 panel waves, by Homuth, Schmitt and Pfost (this volume).

5 Multi-Mode Instrumentation and Method Triangulation

Even though BiKS was organized in several projects from a funding perspective, a truly interdisciplinary culture of discussion and instrumentation was achieved: psychological aspects such as functional competencies, specific skills, and general abilities, personality traits, values, and beliefs were combined with macro-, meso-, and micro-sociological indicators as well as qualitative and quantitative measures of family and institutional learning environments. Based on fine-grained social and migration specific background data, it was possible to examine in great detail stabilities and changes in child development, educational decision-making, and educational trajectories. At all times, profound disciplinary expertise was complemented by interdisciplinary discussion—bringing together substantive expertise, methods, theories for the best instrumentation—clearly accepting the often intense discussions about individual concepts, their role in educational research, and their operationalization. This work contributed to the construction of a unique set of instruments.

Competence and Skill Measurement in Individual and Group Test Settings
Standardized tests for the children and adolescents (and later for the adults) are an essential backbone for understanding children's and adolescents' development and educational biographies and were therefore administered regularly and in great detail in both cohorts. Competence and skill measurement was guided by a systematic framework that distinguishes, amongst other things, between verbal and non-verbal and more or less education-dependent abilities, competencies, skills, and achievements (see Weinert and Artelt 2019, for a conceptual discussion), including, e.g., oral language skills and reading and writing skills in the majority language, mathematics, factual content knowledge, working memory, speed of information processing, non-verbal cognitive abilities, and indicators of metacognitive understanding (for an overview on these measurements in BiKS-3-18 see Weinert and Ebert this volume; for BiKS-8-18, see Homuth, Schmitt and Pfost this volume; Karing et al. this volume; Pfost et al. this volume). Especially in the older age groups, the competence measurements are directly linked to the concept of literacy. In selecting the measurement instruments, care was taken to ensure that they were internationally compatible, could reflect developmental change, and, in some cases, allowed comparisons across different cohort studies (e.g., some instruments developed in BiKS-8-18 were administered in BiKS-3-18 later on and some instruments developed the BiKS-3-18 study were included in

the National Educational Panel Study as well as the other way around). In some waves, parents were also given cognitive tests (e.g., a vocabulary, a knowledge, and a verbal fluency test in the BiKS-3-18 study). The competence and skill tests were administered using paper and pencil instruments and conducted with a high level of standardization. The test setting was implemented as a one-to-one contact between the children and a well-trained semi-professional test administrator (for younger children or when measurements had to be taken in the family home) or in group settings (especially in the school context). For half of the BiKS-3-18 sample, a more detailed and higher frequent measurement of children's competencies was conducted in the early years to explore competence development in more detail (see Weinert and Ebert this volume).

Questionnaires for Targets, Parents, and Educational Staff
In addition to measuring competencies, questionnaires were administered to the children in the BiKS-3-18 cohort (starting in grade 3) and adolescents in the BiKS-8-18 cohort. The target questionnaires capture a wide range of variables including competence-related aspects (such as self-perception of skills and metacognition), motivation and personality, and school-related variables. Because these questionnaires are linked to the competence measurements, they were also administered as paper and pencil instruments. Later, online assessments were also used.

In order to obtain detailed information on family background, educational biographies, parental perception of the child, a range of variables relevant to educational decision-making, and especially qualitative and quantitative aspects of the parental home, parent interviews were also conducted regularly as computer-based face-to-face or telephone interviews. By exploiting filtering options, questions asked could be tailored precisely to the child's particular educational situation (e.g., targeting parents of children enrolled early or late in school or dealing with school changes or grade repetition).

The research questions also included detailed information on preschool and school staff (both at the head level and at the level of the team in charge). The questions cover various aspects of the preschool or school environment (with a strong focus on quality parameters), as well as sociodemographic background variables, values, and perceptions of staff. Preschool and school teachers also provided assessments of the individual children studied, including competencies and socio-emotional and motivational aspects, contributing to research on teacher judgment accuracy. For logistical reasons, mainly paper and pencil instruments were used.

Observational Methods

A distinctive feature of BiKS-3-18, as mentioned earlier, is the use of detailed standardized observation instruments in the family homes as well as in preschools and primary schools (for a selection of interesting results see Rossbach et al. this volume). All the observational measures were conducted by intensely trained und supervised observers, raters/coders, and interviewers, and some were live or video- or audio-based. Because of the large sample size, observational measures could not be included within BiKS-8-18.

Qualitative Subsamples

Although BiKS is primarily quantitative in its large panel studies, it has been usefully supplemented with qualitative information. Qualitative studies and in-depth assessments on well-selected subsamples of parents, children, and educational staff contributed, for example, to a deeper understanding of school enrollment decisions (i.e., the decision to enroll early, see Pohlmann-Rother et al. this volume) and of the situation in Turkish families in BiKS-3-18 (for more details, see Blossfeld and Nester this volume) or to obtaining qualitative data on parents' expectations, aspirations, and perceptions about school careers in BiKS-8-18. In all cases, the broad panel database allowed for a careful selection of cases for the qualitative supplements (or in-depth assessments), but most importantly, this design allowed for triangulation of quantitative and qualitative findings.

6 Extensive Interviewer Training and Panel Care

All fieldwork within BiKS-3-18 and BiKS-8-18 was conducted by well-trained test administrators, observers/raters, and interviewers, with outside fieldwork agencies involved only in parents' interviews and online questionnaire (CASI). In training test administrators and interviewers, particular attention was paid to two types of instruments: (1) for competence and skill tests, a high degree of standardization had to be ensured, including full compliance with instructional texts, feedback rules, and time limits; (2) observational instruments—particularly when assessment had to be conducted online—required theoretical and practical training that lasted up to several days for some of the instruments, with coders trained against predetermined reliability criteria. By investing massively in training test administrators, observers/coders, and interviewers, the BiKS team was able to ensure the best possible data quality.

The implementation of the panel as well as the stability of the panel was supported from the beginning by a well-designed panel support. A stable team of project leaders served as anchors for participant communication. Furthermore, the BiKS team ensured comparably stable contact persons for fieldwork, visits in the institutions convey appreciation for the work done but also to provide direct feedback, carefully selected incentives, and regular flyers and brochures for all participant groups helped to engage and stay in contact with the families and institutions. In addition, well-trained test administrators and interviewers, as well as detailed fieldwork supervision, also contributed to BiKS' success in recruiting institutions and families and throughout the survey phase.

It is important to emphasize that BiKS invested a particularly large amount of time and energy in fieldwork to observe the children at the transitions—especially at the transitions from preschool to primary school and from primary to secondary school. In doing so, it was important to track more than just the more normative educational careers. All participants who left the original preschool or school context (e.g., by changing schools, enrolling early or late, repeating grades, or skipping) were followed up in the BiKS-3-18 and BiKS-8-18 panel studies and interviewed individually in their home environment.

7 Data Usage

The data from both the BiKS-3-18 and BiKS-8-18 cohort studies underwent detailed data cleaning, data editing and documentation, and anonymization. Given the comparably large sample in the first wave with broad coverage, the satisfactory stability of the panel, and the carefully selected and developed instruments, the data are a powerful source for answering a range of research questions about competence development, educational processes, and educational decisions in preschool and school age. Because both cohorts are not limited to a single relevant environment or educational stage, but explicitly focus on the interplay of the family and the respective institutional environments, the data have been used in a variety of ways to provide a deeper understanding of long-term educational trajectories.

The data are available free of charge as Scientific Use Files through the Research Data Center of the Institute for Educational Quality Improvement (IQB; https://www.iqb.hu-berlin.de/fdz). To date, waves 1 to 10 of BiKS-3-18 (Weinert et al. 2013) and waves 1 to 8 of BiKS-8-18 (Artelt et al. 2013) are available, including a detailed documentation[2]; in the coming years, this data offering will successively be expanded to include all waves. The data are available for scientific use based on a contract basis and require an institutional affiliation with a university or a publicly funded research institute. For a first overview, the codebooks as well as blank data sets in SPSS-format of all shared waves can be downloaded from the mentioned website.

8 About This Volume

This volume provides an overview of the two large-scale studies BiKS-3-18 and BiKS-8-18 and summarizes important findings. In these two BiKS studies, large samples of children, their contextual persons (such as parents, and preschool and school teachers), as well as their learning environments were followed from age three (BiKS-3-18) and eight (BiKS-8-18) through adolescence in a comprehensive longitudinal design. The following chapters provide an overview on the design and assessments of the BiKS studies and compile selected important findings, some of which have been published in German and in disciplinary scientific journals but have international and interdisciplinary significance. In addition to the general overview of the research questions and the overall designs of the two BiKS studies given in this chapter, the following 11 chapters present in depth the methods, including sampling procedures, sample development, and broad-based assessments of the two surveys and selected results. These are reported with reference to the various projects that contributed to BiKS and were funded as part of the research unit.

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[2] Information concerning BiKS can be found at the IQB research data center under the following links: https://www.iqb.hu-berlin.de/fdz/studies/BiKS_3-10?doi=10.5159/IQB_BIKS_3_10_v6.

https://www.iqb.hu-berlin.de/fdz/studies/BiKS_8-14/?doi=10.5159/IQB_BIKS_8_14_v2.

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From Preschool to Vocational Training and Tertiary Education—Study Design of the BiKS-3-18 Study

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Abstract

The educational development and achievements of children depend on individual prerequisites as well as on familial and institutional learning contexts. Data from the study BiKS-3-18 (Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age) enables educational research on mechanisms and long-term effects of early child development and different learning environments in Germany. This contribution provides an overview of the study design, sampling procedures

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and sizes, contents, and research potential of the BiKS-3-18 study. Starting in 2005, the study followed preschool children from Bavaria and Hesse from the age of three over fifteen years, from preschool through primary and secondary school, including their educational and vocational career paths beyond compulsory schooling into the labor market or tertiary education. The study comprehensively assessed children's competencies and their familial and institutional learning environments particularly across preschool and primary school (ten assessment waves). Additionally, children's parents and teachers were interviewed. The initial sample consisted of 547 preschool children and added 528 of their classmates in primary school after enrollment. Furthermore, both after the transition from primary to secondary education and after the transition from secondary education to vocational or tertiary education, children and their parents were again tested and interviewed until the children were 18 years old (three additional assessment waves).

Keywords

Preschool · Primary school · Secondary school · Educational trajectories · Longitudinal data

1 Introduction

The BiKS-3-18 study was launched in 2005 to address public and scientific expectations and concerns about the impact of the early years, including home and institutional learning experiences as well as early developmental trajectories for later developmental and educational pathways and outcomes. Its conception was affected by three main research strands: First, the striking findings from randomized control trials in the U.S. showed that high-quality preschool programs such as the Perry Preschool Project (Belfield et al. 2006), the Abecedarian Project (Campbell and Ramey 1994), and the Head Start Program (U.S. Department of Health and Human Services, Administration for Children and Families 2010) were associated with enhanced academic and social development of children into early adolescence and beyond (Barnett 2011; Campbell et al. 2001; for an overview, see Blau and Currie 2006; Burger 2010; Duncan and Magnuson 2013). However, the transferability of the results to public child care arrangements and to other cultural contexts was limited due to small and specifically disadvantaged samples. Second, the results from large scale longitudinal studies investigating the combined effects of different child care and family contexts on children's development within more diverse samples in the U.S. (e.g., the National Institute of Child Health and Human Development [NICHD] Study of Early Child Care and Youth Development; Belsky et al. 2007) and Great Britain (the Effective Provision of Pre-school Education [EPPE]/the Effective Pre-school, Primary and Secondary Education Project [EPPSE]; Sylva et al. 2004) also showed positive effects, but again with the limitation of the cultural transferability to the German context. And third, there was a large research gap in developmental psychology regarding early roots and significant pathways toward later school-relevant competencies. Thus, the idea of a longitudinal study tracking children from preschool entry to school enrollment with a socially and culturally diverse sample was born. By launching the longitudinal BiKS study in 2005, the attempt was made to close the main existing theoretical and empirical research gaps concerning how families, preschools, and primary schools affect developmental and educational processes in their interplay with children's developing individual characteristics (see also von Maurice et al. this volume).

Although its initial focus lied on children's development from the age of three years to the end of primary school, the study accompanied these children further through adolescence and has incorporated an extensive range of measures over the course of children's educational careers. As a consequence, it enables researchers to explore a wide variety of topics ranging from early child care, early educational decisions, and individual child trajectories, including origins of school readiness, to insights into the developmental dynamics, influencing factors, and interrelations between different domains of development such as language, (meta-)cognition, mathematics, and facets of social-emotional development including predictors of early and later social cognition; the interplay between various learning environments synchronous as well as over time, and the specificity of environmental impacts; predictors of children's later social-emotional competencies, aspects of life satisfaction, coping with life, integration into society, and further important issues.

The BiKS-3-18 study focuses on cumulative educational experiences, developmental processes, decision-making processes, and their interrelations that take place over the whole time that children in Germany usually spend in institutional, formal learning environments, i.e., from preschool at age three to the end of upper secondary schooling and the beginning of tertiary education or in vocational education and training (VET) at age 18. Together with BiKS-8-18 (see Homuth et al. this volume), these two studies provided the rich data basis of the two-cohort-study BiKS (see von Maurice et al. this volume).

While other chapters of this volume provide insights into findings of the BiKS study concerning the main research questions as well as more differentiated overviews on the assessments, the present chapter provides a comprehensive overview of the design, the sampling procedure, the sample development, general study contents, and the research potential of the data.

2 Study Design

The unique features of the BiKS-3-18 study include (a) participants growing up in different regions (including urban, suburban, and rural areas) of two federal states within Germany, representing different sociodemographic contexts and varying preschool and school regulations; (b) inclusion of different cultural backgrounds, family forms, and levels of education within families; (c) a sample large enough to permit complex statistical modeling; (d) children followed from age three onwards at the beginning of their institutional educational career; (e) extensive direct observations of home, child care, and school experiences; (f) multiple measures of cognitive, social-cognitive, and language development, of mathematical and literacy skills, educational achievements, and social-emotional development; (g) longitudinal use of multiple quality indicators for the learning environments with differences in scope, method, and depth.

2.1 Multi-informant Panel Design

BiKS-3-18 is a panel study in which children were tested annually, sometimes even semi-annually, in several developmental domains (see Weinert and Ebert this volume). In addition, extensive information about the family and institutional contexts (preschool, primary school, secondary school) was collected through a variety of interviews of parents, teachers, and later the students themselves, as well as direct observations in the family or the classroom (see Fig. 1).

In September 2005, a sample of $n = 547$ preschool children was drawn who would regularly enroll into school in September 2008. This sample was followed through the end of upper secondary schooling and VET. In Wave 1 in 2005, children were on average three and a half years old ($M = 42.2$ months; $SD = 4.1$) and on average 18 years in Wave 13 in 2020 ($M = 218.3$ months; $SD = 4.5$).

In total, individual data on the children and their families were collected at 13 panel waves with six biannual waves during the preschool, four annual waves in the primary school phase, two additional waves in the lower secondary schooling, and one wave in the educational stage of upper secondary education or VET (see Fig. 1). During the preschool period, children's competencies in various domains

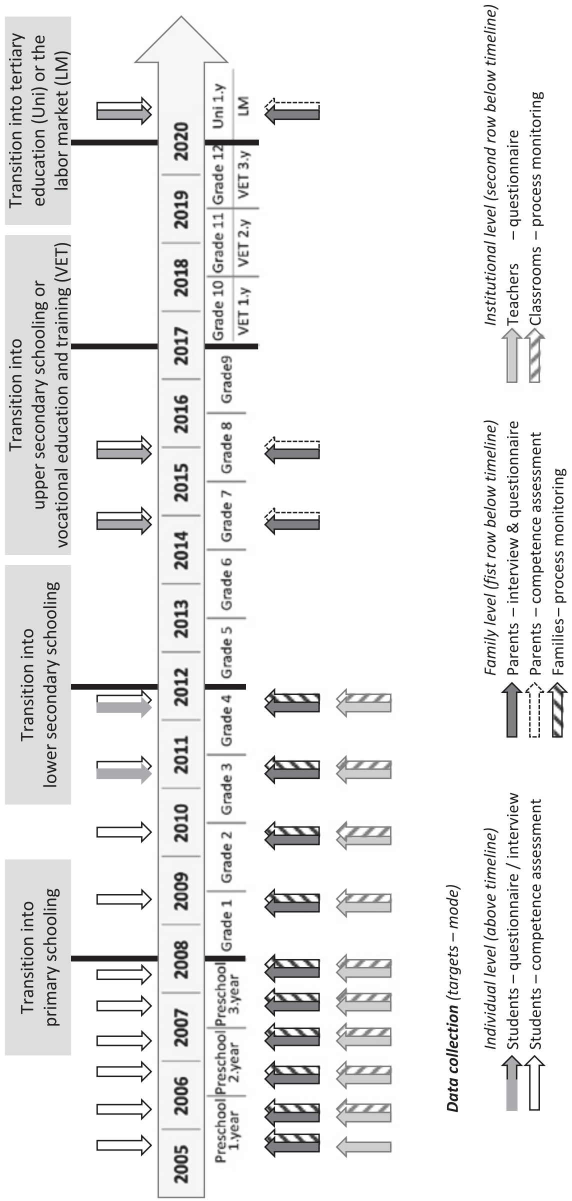

Fig. 1 Study design of BiKS-3-18

were assessed at least yearly for the full sample, while their parents were interviewed and filled out questionnaires to assess, amongst other topics, the familial learning environments which were also directly observed (see Rossbach et al. this volume). A sub-sample of participating children was tested every six months to map their development in this age range in even greater detail (see Weinert and Ebert this volume).

Most waves during the preschool and school period also included observations and questionnaires within the institutional settings. The school or classroom learning environments were assessed partly on a six-month basis, and (pre)school teachers and (pre)school heads were regularly interviewed to be able to analyze classroom and school effects on students' educational developments.

A sub-sample of parents ($n=68$), preschool teachers ($n=29$), and primary school heads ($n=16$) was examined with qualitative interviews during, before, and after the transition from preschool to primary school with a focus on school entry decisions and school readiness (Faust et al. 2013; Pohlmann-Rother et al. this volume). Another sub-sample of systematically selected children ($n=68$) was tested in depth in preschool age with a focus on metacognition, theory of mind, and specific aspects of the home learning environment (see Weinert and Ebert this volume, for details).

Two additional waves were completed after the transition into secondary schooling when children were about 12 and 13 years old. The last wave took place when children were about 18 years old. These final three waves focused only on students, their individual educational status, and their parents. They included competence assessments, interviews, and questionnaires for both students and parents on different aspects of students' educational developments (see Weinert and Ebert this volume, for details).

2.2 Sampling Process

In addition to criteria such as the generalizability and reliability of the data as well as the possibilities for analysis, practical considerations played a role in drawing the initial sample. On the one hand, the sample had to allow statistically reliable statements about the developmental processes and their influencing factors in the target population while considering the greatest possible diversity of family and institutional contextual conditions. On the other hand, this should be feasible with the given time and financial as well as personnel resources, since the design of the BiKS studies with its repeated and extensive data collection represented a major organizational challenge.

Therefore, a multiple stratified random sample was drawn (see Sect. 2.2.2 and Kurz et al. 2007, for a detailed description of the sampling procedure) to ensure feasibility with available resources and to address the research interests regarding a better understanding of child development and educational processes in typical configurations.

2.2.1 Sampling Regions

Bavaria and Hesse were chosen as the survey regions because of the significant differences in the school system in these two federal states. The main institutional differences relevant for the study were different cut-off dates for primary school enrollment as well as different regulations regarding the transition from primary school to secondary school, especially the relative importance of parents' will and teachers' assessment for this transition.

In both federal states, regions with comparable socioeconomic structures were selected. These were one large city (Nuremberg in Bavaria, Frankfurt a. M. in Hesse), one medium-sized city (Bamberg in Bavaria, Darmstadt in Hesse), and two rural districts (districts of Bamberg and Forchheim in Bavaria, districts of Bergstrasse and Odenwald in Hesse). These survey regions provided a wide variety of conditions for individual educational decisions, such as institutional requirements and different regional and local opportunity structures. They offered practical advantages concerning the feasibility of the study (location of the University of Bamberg, deviating legal regulations in Hesse, accessibility and cooperation with other regional research institutions).

The socioeconomic structures of the selected sample regions showed apparent urban-rural differences with regard to population density, economic structure, labor market situation, and the proportion of migrants, which persist today. There are clear differences between the two federal states with regard to the economic structure (stronger agricultural character in the Bavarian districts vs. densification in the Hessian districts) and the proportion of migrants (significantly higher in Hessian districts). Differences in the preschool and school situation in the selected counties are mainly due to the higher frequency of preschools run by the Catholic Church in all Bavarian districts (except Nuremberg). In contrast, preschools in Hesse were primarily run by local authorities. Furthermore, the proportion of migrants in Hessian preschools and schools is in some cases significantly higher; this is especially true in the cities of Frankfurt and Darmstadt.

2.2.2 Two-Stage Sampling Process

In the first step of sampling, preschools were selected in which children within a specific birth window were recruited in a second step. The population for the first step was narrowed down using five criteria and further exclusion criteria. The stratification criteria for a targeted sample of 100 preschools and 600 children were (see Kurz et al. 2007; von Maurice et al. 2007):

- Disproportionate stratification by federal state: Bavarian and Hessian preschools in a ratio of 60 to 40.
- Disproportionate stratification of the number of study preschools by the major cities of Nuremberg and Frankfurt (33% of preschools each) and the remaining districts (67% of preschools each).
- Disproportionate stratification with respect to the proportion of migrants in the preschools from Frankfurt and Nuremberg. For this purpose, three groups of migrant shares were formed: low = preschools with less than 10% of the children, medium = preschools with 10% to less than 50%, high = preschools with 50% and more. The target was 33% of each of the three groups.
- Proportional stratification based on the number of groups in the preschools to ensure an equal probability of selection for all children regardless of the size of the preschool (see Sect. 4.1 for the description of the final sample).
- Disproportionate stratification based on the number of primary schools the target children would enroll in: For practical reasons, i.e., to ensure successful tracking of the children across institutional contexts, 90% of the sample were composed of preschools whose children regularly transfer to only one primary school. The remaining 10% consisted of preschools with three or more transitional primary schools. Thus, preschools with exactly two receiving primary schools were excluded.
- Further restrictions such as the exclusion of special needs preschools or preschools with special educational concepts (e.g., Waldorf, Montessori) to ensure better comparability of the learning conditions on the one hand and the focus on generalizable encountered institutional conditions rather than particular educational concepts on the other hand.

After applying these stratification criteria, the sampling frame consisted of 688 preschools. First, the 178 sponsors were contacted, and after their written acceptance, the institution heads and the pedagogical staff were invited to participate in the study. In the end, 97 facilities were recruited in this way. Only one group was selected from each participating preschool; often, only one group per preschool was eligible.

Only children who became of school age in the 2008/2009 school year were selected for inclusion in the study. Thus, the birth window in Bavaria was between 01.10.2001 and 31.10.2002 and in Hesse between 01.07.2001 and

30.06.2002 due to different cut-off dates for school enrollment in the two federal states. The families of the selected children were finally invited to participate. The willingness of the contacted parents to participate was relatively high, with 75% in Bavaria and 78% in Hesse, so that a sample size of altogether $n = 547$ participating target children and their families could be realized.

2.3 Sample Enhancements

After the initial sampling, the BiKS-3-18 sample was expanded at several points.

2.3.1 Refreshment

Due to previous studies on selective access to preschools at the time (cf. Fuchs 2005; Kreyenfeld 2007) and to be able to examine the effects of the duration of preschool attendance, an attempt was made from the second year of the study onward to recruit additional children who had entered preschool at a later age. Since the participation rates at preschool age were almost 90% in Germany (Autorengruppe Bildungsberichterstattung 2008), only 14 families were eligible for later inclusion. Of these families, seven children could be recruited to participate (five children in Wave 3 and two in Wave 5), resulting in a final sample of $n = 554$.

2.3.2 Returns

The main reason for sample dropouts between Waves 1 and 6 was moving families or when participating children changed preschools. At the time of primary school enrollment, all 60 families who could no longer participate in the study due to a change of preschool were contacted again. Of these, 24 returned to the study in the first grade of primary school (Wave 7).

A similar procedure was undertaken when contacting parents and children again for the assessments when children were in secondary education. It was again possible to include them due to the change of the tracking strategy (see Sect. 2.4) in this study phase. All families that did not actively withdraw their participation in the study were contacted again in 2014.

2.3.3 Class Complement Sample

The third and largest enhancement of the initial sample took place at the time of school enrollment by including the school and class context of the participating children (cf. Schmidt et al. 2009). The classmates of the previously accompanied children were added to the sample to include the class context into analyses. The following procedure was used to select the primary schools to which the children in the original sample transferred:

First, schools outside the BiKS survey regions or special types of schools (i.e., private schools, schools with a special educational concept, and special needs schools) were excluded due to insufficient case numbers, unsuitable implementation conditions, and excessive costs. This affected seven schools with a total of ten participating children.

A total of 71 schools in Bavaria and 46 schools in Hesse were contacted, of which 58 and 29 could finally be recruited, respectively. In every school, at least one class was to be included. In schools with more than one eligible class, the one with the most participating children and classes attended by at least three children from the initial sample were included.

In 142 participating classes, all classmates and their parents were invited to the study. The response rates on the class and school levels showed a large variance between the different survey regions (cf. Schmidt et al. 2009). Of the 1,403 families contacted, 528 agreed to participate, so 999 children were in the sample after this enhancement. All these children were tracked longitudinally through primary school and beyond.

2.4 Tracking Strategy

With school enrollment, school participation patterns resulted in three subgroups with different tracking and competence assessment strategies (see Fig. 2). First, if possible, all participating children of the initial sample (including Refreshment and Returns) were tracked and tested in the school and classroom context (with additional tests being presented to these children at home; see Weinert and Ebert this volume, for more details). If this was not possible, either because they attended a school with too few other study participants or because the school was unwilling to participate, the children were tracked and tested individually (see Weinert and Ebert this volume). Initially, in Wave 7, this affected 94 of the 471 remaining children of the initial sample.

In Wave 7, overall, 880 children were tracked in school context: a total of 352 children of the initial sample and 528 classmates, while 25 children were still tracked in preschools. When schools terminated participation during the study, children of the initial sample were then tracked individually; over the course of the study, this applied to 52 children. Their affected classmates were not followed up (individually) during primary school, but contacted again in Wave 11; this affected 39 children. In addition, 25 children of the initial sample who were still in preschool in Wave 7 were tracked after their enrollment either in the classroom context ($n = 12$) or individually.

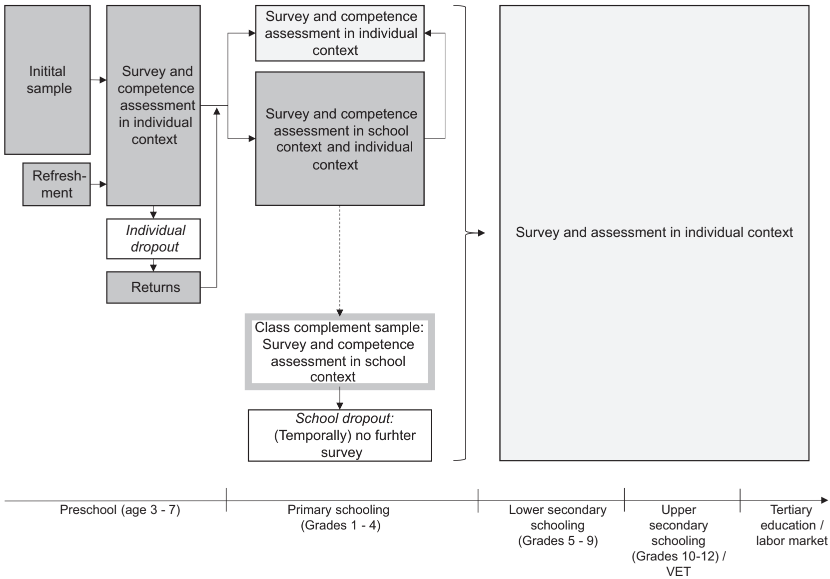

Fig. 2 Tracking strategy in BiKS-3-18

In Waves 11, 12, and 13, all participants were tracked individually. While the assessments in Waves 11 and 12 took place at home, in Wave 13, students and their parents mostly completed questionnaires online (6.3% of parents opted for a paper questionnaire). In addition to the previously individually tracked participants and those who were followed in a class context, all former participants who were not surveyed by design (i.e., students from the class complement sample whose school ended their participation or who changed (pre)schools during the first waves) were also included in this phase of the study (see Weinert et al. 2021, for details on Wave 13).

3 Sample Development

3.1 Panel Participation

In the beginning, 547 children participated in the study. This number remained relatively stable over the first six waves (see Fig. 3). Most dropouts were due

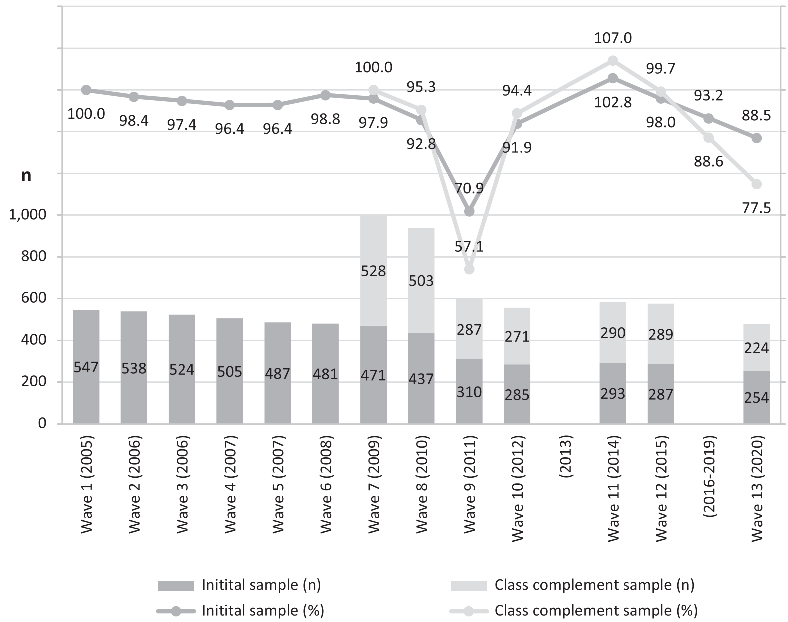

Fig. 3 Development of the BiKS-3-18 sample (absolute) and panel participation rates (in percent)

to children leaving the studied preschools, mostly because families moved for unrelated reasons. By the time most of the children would enroll in primary school in 2008, 481 children (after Wave 6) were still participating in the study, representing 87.9% of the initial sample.

After enrollment, 528 classmates joined the remaining 471 children in Wave 7. This led to a total sample size of 999 children. In the last wave of primary school (Wave 10), 285 children (52.1%) of the initial sample and 271 of their classmates (51.3%) were still participating.

After the transition into secondary schooling and due to the change in the tracking strategy, the sample increased in Wave 11 to 293 participants of the initial sample and 290 of the class complement sample. In Wave 13, 254 students (46.4%) of the initial sample and 224 classmates (42.4%) were still participating.

The BiKS-3-18 sample exhibits very high panel stability. Concerning panel participation rates[1] of the remaining participants from every wave to its respective previous wave, it is noticeable that the panel stability is consistently above 96% during preschool, i.e., up to and including Wave 6. From primary school entry onwards (between Waves 6 and 10), panel mortality increases slightly, with panel stability reaching a low of only 70.9% for children of the initial sample and 57.1% for children of the class complement sample in Wave 9. However, panel participation rates return to the original high level in the last wave at the end of primary school and stay high after the change of the study design from the point when children were in secondary schooling and onwards.

The sharp decline in panel participation in Wave 9 was attributable to the Bavarian sub-sample alone. Particularly strong effects of social origin on the probability to leave the study could be found immediately before Wave 9 for children of the class complement sample in Bavaria. This decline in panel participation was due to a mandated additional *active* panel consent procedure which was only necessary in Bavaria (due to a change in data protection law). Further analyses also showed that those families who dropped out of the study due to the non-availability of consent forms did not differ significantly in socio-demographic characteristics from those who left the study for other reasons (Homuth et al. 2017). Although panel participation rates also fell in Hesse after school entry (Waves 7 to 10), they remained consistently in the range of about 90% for children of the initial sample and the class complement sample. In Bavaria, on the other hand, panel participation rates were over 90% also after school enrollment (Waves 7 and 8). Participation dropped in Wave 9 to 66.5% for children in the initial sample and 71.2% for children of the class complement sample. While participation rates of families of the initial sample recovered slightly to 83.3% at the last wave in primary school (Wave 10), they dropped further to 60.8% for children of the class complement sample (see Homuth et al. 2017, for more information and further explanation).

3.2 Educational Trajectories

BiKS-3-18 allows analyses of students' educational trajectories from the beginning of preschool to the end of secondary education and beyond. Figure 4

[1] Panel participation rate is defined as the share of remaining gross panel sample of the gross panel sample of the respective previous panel wave. Response rates of all instruments by waves are provided in Table 3.

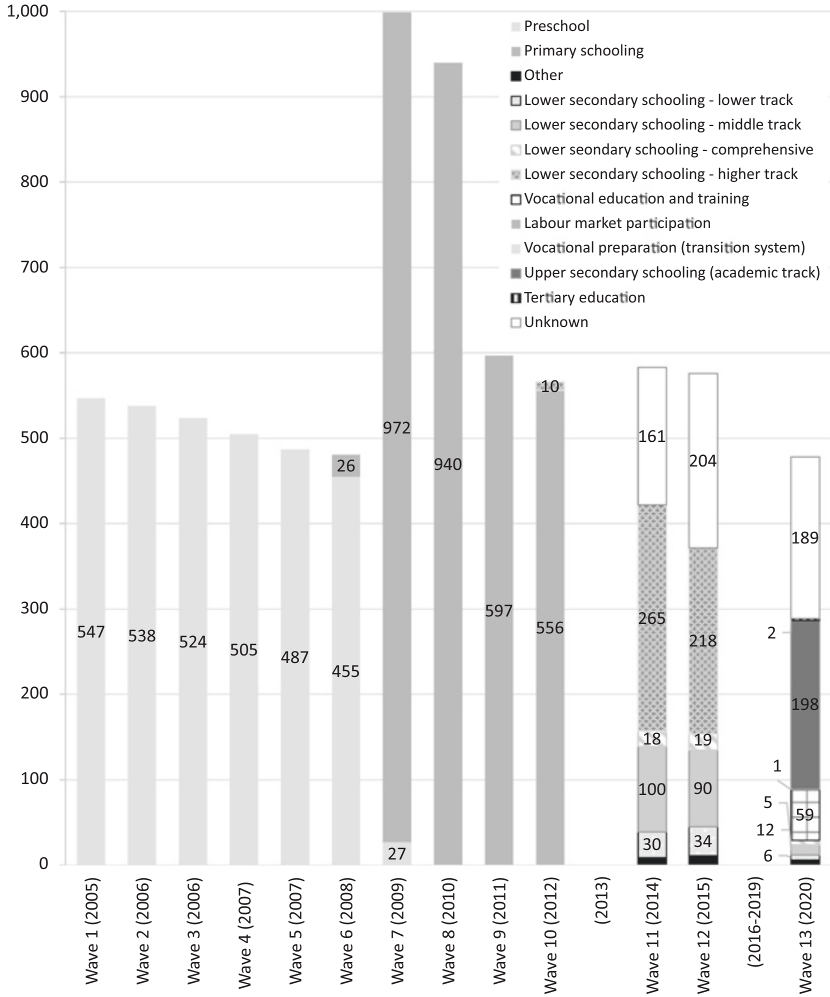

Fig. 4 Educational status of the BiKS-3-18 sample by wave

presents the educational status of the sample in each wave. During the first five waves, all children attended preschools. A small sub-sample of students (5.4%) had enrolled early in primary schools before compulsory education. In Wave 7, most of them had enrolled in primary schools, and only a minority of the initial sample (5.6%) still attended preschool (see Faust et al. 2013; Pohlmann-Rother et al. this volume).

Waves 7 to 10 cover four years of primary education for the extended sample (the initial sample plus the class complement sample). Wave 10 was the last one before students' transition into the tracked system of secondary schooling when educational trajectories usually begin to diverge in Germany. At that time, most of the sample (98.2%) attended Grade 4.

By the time of Wave 11, all participants had transitioned to lower secondary education. Most were interviewed and tested when they were in Grade 7 (around 88% of the sample). The majority (62.8%) had transitioned into the academic track (*Gymnasium*).

By the time of Wave 13, five years after Wave 12, the majority of the sample (68.5%) were in upper secondary schooling (*Gymnasiale Oberstufe*) and close to graduation. 20.4% of the sample were in VET.

Due to the change of the tracking strategy from mainly school-based tracking to individual tracking and the two-year gap between Wave 10 and Wave 11, there were quite large shares of the sample (around 25%) without available information on their current educational status due to nonresponse in Waves 11 to 13.

4 Sample Description and Selectivity

4.1 Sample Description

Selected characteristics of the BiKS-3-18 sample at different educational stages are presented in Table 1. At the beginning of the study, participating children were on average 42.2 months old. While the sex distribution was initially slightly more male-oriented (51.9%), the distribution changed over the course of the study in favor of girls, who made up 52.3% after 15 years in Wave 13. By design, regional distribution was strongly oriented towards students in Bavaria, which resulted in around two-thirds of the sample. Most children came from families with higher educated parents, with 49.3% of families where both parents had a university entrance qualification (*Abitur*). Regarding the migration background of the families, with 21.8% in Wave 1, the BiKS-3-18 sample showed slightly

Table 1 Sample description

Wave	Wave 1	Wave 6	Wave 7	Wave 10	Wave 11	Wave 13
Time	Sept. 2005	March 2008	March 2009	March 2012	May 2014	May 2020
Educational stage	1st year of pre-school	3rd year of preschool	Primary school Grade 1	Primary school Grade 4	Secondary schooling Grade 7	End of secondary schooling / vocational education
Sample size	547	481	999	556	583	478
Age in months	$M=42.2$ $SD=4.1$	$M=72.3$ $SD=4.1$	$M=84.4$ $SD=4.7$	$M=120.3$ $SD=4.6$	$M=146.2$ $SD=4.7$	$M=218.2$ $SD=4.5$
Sex	51.9% male 48.1% female	50.5% male 49.5% female	47.8% male 52.5% female	46.9% male 53.1% female	48.5% male 51.5% female	47.7% male 52.3% female
Federal state	64.5% Bavaria 35.5% Hesse	64.2% Bavaria 35.8% Hesse	67.8% Bavaria 32.2% Hesse	56.7% Bavaria 43.3% Hesse	65.2% Bavaria 34.8% Hesse	67.0% Bavaria 33.0% Hesse
Socioeconomic status [a]	$M=54.6$ $SD=15.4$	$M=55.1$ $SD=15.5$	$M=54.6$ $SD=15.2$	$M=55.8$ $SD=15.2$	$M=55.8$ $SD=14.7$	$M=54.5$ $SD=15.8$
Parental general education [b]						
Lower secondary [quali. Hauptschule]	18.3%	18.2%	17.1%	11.6%	12.9%	16.5%
Medium secondary [Mittlere Reife]	32.4%	31.9%	32.2%	33.3%	33.1%	34.8%
University admission [Fach-/Abitur]	49.3%	49.9%	50.8%	55.1%	54.0%	48.7%

(continued)

Table 1 (continued)

Wave	Wave 1	Wave 6	Wave 7	Wave 10	Wave 11	Wave 13
Migration background [c]						
Without migration background	78.2%	79.4%	78.4%	80.0%	78.3%	75.1%
At least one parent with another mother tongue than German	21.8%	20.6%	21.6%	20.0%	21.7%	24.9%

Notes: [a] Measured in the family's highest International Socio-Economic Index of Occupational Status (HISEI; Ganzeboom et al. 1992). Highest value over all panel waves; rate of missing values = 5.3%. [b] Highest value over all panel waves; rate of missing values = 6.8%. [c] Rate of missing information = 3.3%.

fewer migrants than would be expected from the overall distribution in Germany in 2005 with up to around 32% (Destatis 2017).[2]

4.2 Sample Attrition and Selectivity

When considering the sample dropout, the question arises whether the dropouts are neutral with respect to central sample indicators. Overall, there generally was no particular selectivity in sample attrition. The differences found are within the range expected in longitudinal studies (Table A1 in the Appendix provides the results of regression analyses of the participation for each panel wave). Overall sample attrition was less pronounced during the preschool years than during the school years. The single exception was the selective dropout in the Bavarian subsample due to the exogenous shock of the law change (see Sect. 3.1).

As expected from longitudinal studies (Rendtel 1995), participating families usually have a higher socioeconomic status and higher educational qualifications than non-participants. Compared to the children in the initial sample, these differences are somewhat more pronounced for children of the class complement sample, especially for the probability of dropout by familial socioeconomic status.

However, a closer look reveals that significant socially selective dropout occurred only at two certain stages of the study. First, for the children of the initial sample, selective dropouts occurred primarily at Wave 5. In general, dropouts in the preschool period (Waves 1 to 6) were mainly due to preschool changes or when families moved out of the study regions. One plausible explanation for the social selectivity of these dropouts could be that such changes might occur more frequently in facilities with special support services and thus, tend to affect children from lower social strata or educationally disadvantaged families (Autorengruppe Bildungsberichterstattung 2014).

Second, in the last two survey waves during primary school (Waves 9 and 10), significant socially selective dropouts occurred, especially for the participants

[2] Children were here defined as migrants if one or both parents had a non-German mother tongue. This definition is very likely to be an underestimation compared to the definition of the Mikrozensus, which is based on the family members' countries of birth. We chose this definition because of the significantly higher share of missing information on countries of origin for both parents (13.3% vs. 3.3%). Using the country-of-origin definition, 24.0% of the BiKS-3-18 sample have a migration background. The correlation between these two measures is $r_s = .87$.

of the class complement sample. On the one hand, this can be explained by the mandated additional active panel consent procedure, which was only necessary in Bavaria, and on the other hand, by the upcoming transition from primary into secondary school, which puts families under pressure and resulted in higher dropouts.

Measured by the parents' highest educational attainment in the overall sample, there was no systematic correlation between school-leaving qualifications and dropout probability within the first six waves (preschool period). Only in Waves 5 and 9, there was a significant correlation between the parents' highest educational attainment and participation. However, this can only be observed in Bavaria, not in Hesse. The causes are the same as those described above.

The development of the total sample concerning the migration background of the children did not show any particular anomalies. At the beginning of the study (Wave 1), 21.8% of the sample had at least one parent whose mother tongue was not German. At the beginning of the school years (Wave 7), this figure was 21.6%, and at the end of primary schooling (Wave 10), 20.0% of the sample. These slight changes can also be attributed to the Bavarian sub-sample, in which the share of children with a migration background decreased by 4.8 percentage points from Wave 1 to Wave 10 while the share of migrants in the Hessian sub-sample remained stable over the same period.

5 Contents of the Study

5.1 Instruments and Measurement Times

The BiKS-3-18 longitudinal study is characterized by the parallel investigation of child development in different contexts, which resulted in the use of many data collection instruments in different modes (cf. Table 2). On the one hand, child development was continuously measured through standardized tests and assessments in individual or group settings in various developmental domains (see Weinert and Ebert this volume, for further information). On the other hand, the learning environments in the family and in institutions (preschool and primary school) were also examined using questioning and observation procedures (see Rossbach et al. this volume, for further information). Next to the children, parents were the most important participants for the longest time of the study. They were contact persons and provided information on children's familial development and learning context (as well as on developing child characteristics).

Table 2 Overview of instruments

Target / Instrument	Waves	Mode	Contents
Children			
Student questionnaire	9–13	PAPI, CAWI	Students' attitudes toward school, learning, motivation, socio-emotional skills, life satisfaction, language use, and information on their home learning environment
Standardized assessment of child development (individual setting)	1–13	DA, PBA, TBA	Standardized assessment of domain-specific and domain-general development in the (meta-)cognitive and language area, e.g., vocabulary, grammar, text comprehension, nonverbal cognition, mathematical competencies, factual and common knowledge
Standardized assessment of child development (group setting)	7–10	PBA	Competencies measurement in a classroom setting in various domains, including nonverbal cognition, language, reading, mathematics
Parents and family			
Parent questionnaire including child-related assessment sheet	1–13	PAPI, CAWI	Judgements of various child characteristics, interests, strengths, including motivational and socio-emotional aspects, and judgements of the educational institutions attended by the child
Family activity list	2–10	PAPI	Daily activities in the family
Parent interview	1–12	CAPI, CATI	Housing situation, the family's financial situation, the child care history, experiences with preschool, the family's endowment with cultural capital, everyday family life, child-rearing and educational attitudes, aspects of the child's social-emotional behavior, his/her development, and the child's goals or educational aspirations of the parents for the child are recorded
Process monitoring in the family	1–10	OLR	Semi-standardized tasks to capture global and domain-specific stimulation quality within families

(continued)

Table 2 (continued)

Target / Instrument	Waves	Mode	Contents
Parental competence assessment	11–13	DA, TBA	Indicator of parent vocabulary, verbal fluency, common knowledge
Preschool teachers and heads			
Teacher questionnaire	1–6	PAPI	Preschool-specific characteristics, including both structural and process-related characteristics as well as personal characteristics of the teachers (e.g., training and attitudes)
Child-related assessment sheet	1–7	PAPI	Assessments of preschool teacher's judgement of various child abilities and characteristics, including motivation and social-emotional facets
Preschool activities list	2–6	PAPI	Daily activities in the preschool on group level
Head questionnaire	1–5	PAPI	Structural aspects of the preschool and their usage, training and attitudes of the heads, the goals and guidelines of the preschool's educational work
Process monitoring in preschools	2–6	OLR	Structural features, assessment of teacher–child interaction, global and domain-specific stimulation quality at the group level
Target child monitoring	2–6	OLR	Assessment of global and domain-specific learning quality at the child level (teacher support and child activities)
Primary school teachers and heads			
Class teacher questionnaire	7–10	PAPI	Structural and teachers' personal characteristics (e.g., education and attitudes) on the class level
Child-related assessment sheet	7–10	PAPI	Teacher judgements of child characteristics, including e.g., child abilities, motivation, social-emotional characteristics
Classroom lesson diary	7-9a	PAPI	Lesson design, progress, and corresponding student behavior

(continued)

Table 2 (continued)

Target / Instrument	Waves	Mode	Contents
Head questionnaire	8	PAPI	Structural aspects of the school and their use, as well as issues related to training and attitudes of the school's leadership towards goals and guidelines of instructional design
Process monitoring in primary schools	7a-9a	OLR	Classroom observation with a live rating of teacher-student interaction and learning atmosphere as well as audio recording of teacher language

Notes: Listed contents represent the main topics of the instruments over all waves and not all contents were measured in all listed waves. CAPI = Computer-assisted personal interview. CATI = Computer-assisted telephone interview. CAWI = Computer-assisted web interview. OLR = Direct observation and live rating by an interviewer. PBA = Paper-based assessment. PAPI = Paper and pencil interview. DA = Direct assessment. TBA = Technology based assessment

The combination of different and very complex research methods enables complex questions to be addressed about the conditions of child development at preschool and school age. During the preschool and primary school phase, several survey, testing, and observational instruments were used. In later waves, i.e., during and beyond the secondary school and VET phases, only survey and testing instruments, though no observational instruments were employed.

In addition, to study the formation and probation of decisions about the time of school enrollment, i.e., if a child would be enrolled early at a younger age, at the regular time given by the different state laws, or one year later, BiKS-3-18 included qualitative instruments for mixed-methods-analyses (see Kratzmann et al. 2012; Pohlmann-Rother et al. this volume). This design included semi-standardized face-to-face interviews with parents, preschool teachers, and primary school heads. Parents were asked about their attitudes and expectations towards the time of enrollment into primary school and the probation of the decision made. The interviews with preschool heads addressed procedures for untimely enrollment and experiences of school heads as well as their understanding of school readiness. Primary school heads were asked about their attitudes towards school enrollment dates, perceptions of school readiness, and expected demands of school for school beginners, as well as the cooperation of selected preschool teachers with primary schools.

5.2 Realization of the Measurement Points and Response Rates

Response rates were unevenly distributed across the instruments used (see Table 3). In the case of the standardized assessments of children's competencies, rates of between 84 and 98% were consistently achieved. Response rates for survey instruments such as child-related assessment sheets, questionnaires, or activity lists for preschool and primary school teachers, and families proved to be much lower (as low as 38%). Some of these instruments are very comprehensive and time-consuming. The lower response rates compared to the standardized tests on children's domain-specific and domain-general development in the (meta-) cognitive and language area are mainly based on the more limited possibilities to control the data collection context by the project team (paper self-questionnaire for teachers vs. standardized live rating).

Competence assessments in the sub-sample that was individually tracked during primary school were performed at the students' homes. This was possible because families of the initial sample were visited for the assessment of learning situations at home anyway; therefore, all children of the initial sample were additionally presented with standardized tests that afforded an individual test setting and had already been administrated at preschool age (see Weinert and Ebert this volume, for an in-depth overview).

6 Research Potentials of BiKS-3-18

The BiKS-3-18 study offers a broad dataset that allows high-quality empirical education research within the German education system from an interdisciplinary perspective. Therefore, the BiKS study has contributed and will contribute substantially to a better understanding of children's education-related development and of the effects of various learning environments on a range of cognitive and so-called "non-cognitive" outcomes as well as on the development and interrelations of both kinds of outcomes. This is possible as the BiKS-3-18 study is a longitudinal study including repeated information on different competencies and skills from various informants. Amongst others, the availability of a range of explanatory factors and outcomes allows to investigate which outcomes are

Table 3 Response rates by instruments and waves

Wave	Instrument	Mode	Sample size	Valids [a]	Response (rate)
Wave 1	Competence assessment	PBA	547	535	97.8%
	Parent interview	CAPI	547	547	100.0%
	Parent questionnaire	PAPI	547	442	80.8%
	Process monitoring in the family	OLR	547	543	99.3%
	Preschool teacher questionnaire	PAPI	547	540	98.7%
	Preschool head questionnaire	PAPI	547	547	100.0%
	Child-related assessment sheet	PAPI	547	502	91.8%
Wave 2	Competence assessment [c]	PBA	257	252	98.1%
	Parent questionnaire	PAPI	538	358	66.5%
	Family activity list	PAPI	538	292	54.3%
	Preschool teacher questionnaire	PAPI	538	480	89.2%
	Child-related assessment sheet	PAPI	538	429	79.7%
	Preschool activities list	PAPI	538	452	84.0%
	Process monitoring in preschools	OLR	538	535	99.4%
	Target child monitoring [b]	OLR	102	102	100.0%
Wave 3	Competence assessment	PBA	524	517	98.7%
	Parent interview	CATI	524	501	95.6%
	Parent questionnaire	PAPI	524	335	63.9%
	Family activity list	PAPI	524	285	54.4%
	Process monitoring in the family	OLR	524	415	79.2%
	Preschool teacher questionnaire	PAPI	524	520	99.2%
	Preschool head questionnaire	PAPI	524	464	88.6%
	Child-related assessment sheet	PAPI	524	449	85.7%
	Preschool activities list	PAPI	524	323	61.6%
	Process monitoring in preschools	OLR	524	301	57.4%
	Target child monitoring [b]	OLR	102	98	96.1%
Wave 4	Competence assessment [c]	PBA	257	235	91.4%
	Parent questionnaire	PAPI	505	373	73.9%
	Preschool teacher questionnaire	PAPI	505	455	90.1%
	Child-related assessment sheet	PAPI	505	448	88.7%
	Process monitoring in preschools	OLR	505	491	97.2%
	Target child monitoring [b]	OLR	102	98	96.1%

(continued)

Table 3 (continued)

Wave	Instrument	Mode	Sample size	Valids [a]	Response (rate)
Wave 5	Competence assessment	PBA	487	453	93.0%
	Parent questionnaire	PAPI	487	301	61.8%
	Parent interview	CATI	487	437	89.7%
	Process monitoring in the family	OLR	487	432	88.7%
	Family activity list	PAPI	487	273	56.1%
	Preschool teacher questionnaire	PAPI	487	465	95.5%
	Preschool head questionnaire	PAPI	487	375	77.0%
	Child-related assessment sheet	PAPI	487	390	80.1%
	Preschool activities list	PAPI	487	363	74.5%
	Process monitoring in preschools	OLR	487	265	54.4%
	Target child monitoring [b]	OLR	102	94	92.2%
Wave 6	Competence assessment	PBA	481	434	90.2%
	Parent questionnaire	PAPI	481	319	66.3%
	Parent interview [d]	CATI	26	20	76.9%
	Family activity list	PAPI	481	293	60.9%
	Preschool teacher questionnaire	PAPI	481	428	89.0%
	Child-related assessment sheet	PAPI	481	388	80.7%
	Preschool activities list	PAPI	481	340	70.7%
	Process monitoring in preschools	OLR	481	461	95.8%
	Target child monitoring [b]	OLR	102	94	92.2%
	Primary class teacher questionnaire [d]	PAPI	26	19	73.1%
Wave 6a	Child-related assessment sheet [e]	PAPI	27	19	70.4%
	Parent questionnaire	PAPI	1,021	338	33.1%
Wave 7	Competence assessment (individual) [f]	PBA	471	414	87.9%
	Competence assessment (group)	PBA	999	887	88.8%
	Parent questionnaire [f]	PAPI	471	269	57.1%
	Parent interview	CATI	999	887	88.8%
	Family activity list [f]	PAPI	471	247	52.4%
	Process monitoring in the family [f]	OLR	471	407	86.4%
	Child-related assessment sheet [e]	PAPI	27	16	59.3%
	Class teacher questionnaire	PAPI	999	640	64.1%
	Classroom lesson diary	PAPI	999	661	66.2%

(continued)

Table 3 (continued)

Wave	Instrument	Mode	Sample size	Valids [a]	Response (rate)
Wave 7a	Parent questionnaire [h]	PAPI	21	15	71.4%
	Class teacher questionnaire [g]	PAPI	23	12	52.2%
	Process monitoring in primary schools	OLR	945	700	74.1%
Wave 8	Competence assessment (individual) [f]	PBA	437	326	74.6%
	Competence assessment (group)	PBA	940	737	78.4%
	Parent questionnaire [f]	PAPI	437	186	42.6%
	Parent interview	CATI	940	801	85.2%
	Family activity list [f]	PAPI	437	191	46.4%
	Process monitoring in the family [f]	OLR	437	329	75.1%
	Class teacher questionnaire	PAPI	940	510	54.3%
	Process monitoring in primary schools	OLR	940	684	72.8%
	Child-related assessment sheet [i]	PAPI	896	506	56.5%
	Classroom lesson diary	PAPI	940	446	47.5%
	Head questionnaire	PAPI	940	623	66.3%
Wave 8a	Class teacher questionnaire [g]	PAPI	891	246	27.6%
	Classroom lesson diary	PAPI	891	303	34.0%
	Process monitoring in primary schools	OLR	891	513	57.6%
Wave 9	Student questionnaire	PAPI	597	358	60.0%
	Competence assessment (individual) [f]	PBA	310	272	87.7%
	Competence assessment (group)	PBA	597	444	74.4%
	Parent questionnaire [f]	PAPI	310	174	56.1%
	Parent interview	CATI	597	456	76.4%
	Family activity list [f]	PAPI	310	161	51.9%
	Process monitoring in the family [f]	OLR	310	273	8.6%
	Class teacher questionnaire	PAPI	597	282	47.2%
	Child-related assessment sheet	PAPI	597	279	46.7%
Wave 9a	Class teacher questionnaire [g]	PAPI	185	51	27.6%
	Classroom lesson diary	PAPI	680	228	33.5%
	Process monitoring in primary schools	OLR	680	358	52.7%

(continued)

Table 3 (continued)

Wave	Instrument	Mode	Sample size	Valids [a]	Response (rate)
Wave 10	Student questionnaire	PAPI	556	394	70.9%
	Competence assessment (individual) [f]	PBA	285	248	87.0%
	Competence assessment (group)	PBA	556	494	88.9%
	Parent questionnaire [f]	PAPI	285	155	54.4%
	Parent interview	CATI	556	446	80.2%
	Family activity list [f]	PAPI	285	149	52.3%
	Process monitoring in the family [f]	OLR	285	246	86.3%
	Class teacher questionnaire	PAPI	556	286	51.4%
	Child-related assessment sheet	PAPI	556	293	52.7%
Wave 11	Student questionnaire	PAPI	583	406	69.6%
	Competence assessment	PBA	583	434	74.4%
	Parent questionnaire	PAPI	583	408	70.0%
	Parent interview	CATI	583	469	80.5%
	Parental competence assessment	PBA	583	414	71.0%
Wave 12	Student questionnaire	PAPI	576	166	28.8%
	Competence assessment	PBA	576	447	77.6%
	Parent questionnaire	PAPI	576	164	28.5%
	Parent interview	CATI	576	446	77.4%
	Parental competence assessment	PBA	576	414	71.9%
Wave 13	Student questionnaire	CAWI	478	289	60.5%
	Student competence assessment	TBA	478	259	54.2%
	Parent questionnaire	CAWI	478	320	66.9%
	Parent competence assessment	TBA	478	239	50.0%

Notes: [a] The numbers for instruments on the class or school level relate to the number of children for whom at least one valid instrument is available. [b] Only for a sub-sample of children. [c] Only for a sub-sample of children in Bavaria. [d] Only for early enrolled children. [e] Only for children who were not enrolled in primary school. [f] Only administered to/completed for children from the initial sample (including refreshment and returns). [g] This questionnaire contained basic information about teachers and was completed by teachers only once. [h] Only for late-enrolled children. [i] Only for children who enrolled regularly affected by common and specific factors in different phases of child development (the *complementarity principle* and/or *the specificity principle* in child development; Bornstein 2019; Malti and Cheah 2021).

Data of the BiKS-3-18 study are available to researchers on request at the Research Data Centre of the Institute of Quality Development at the Humboldt-Universität zu Berlin (FDZ at IQB). Furthermore, on the Website of the FDZ at IQB, a list of publications using the data of the BiKS-3-18 study is available. Publications in this volume provide an overview over the most investigated topics within the BiKS-3-18 study available to date.

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We would like to sincerely thank all participants as well as all those who contributed to the survey and evaluations for their great commitment.

Appendix

See (Table A1).

Table A1 Explaining continued participation in the study

Wave	2	3	4	5	6	7	8	9	10	11	12	13
Sex: Female (Ref. Male)												
	0.012	0.045	0.019	0.072	0.000	0.044	0.001	0.020	−0.013	−0.032	−0.033	0.076
	(0.012)	(0.016)	(0.017)	(0.016)	(0.009)	(0.024)	(0.014)	(0.031)	(0.020)	(0.038)	(0.038)	(0.044)
Age in months												
	0.055	0.010	0.014	−0.046	0.112	0.020	0.021	−0.085*	−0.032	−0.039	−0.042	−0.003
	(0.001)	(0.002)	(0.002)	(0.002)	(0.001)	(0.003)	(0.001)	(0.003)	(0.002)	(0.004)	(0.004)	(0.005)
Federal state: Hesse (Ref. Bavaria)												
	−0.058	0.049	−0.014	0.069	−0.065	0.029	0.032	0.325***	−0.031	−0.090	−0.090	−0.031
	(0.015)	(0.018)	(0.021)	(0.015)	(0.013)	(0.026)	(0.013)	(0.031)	(0.022)	(0.043)	(0.043)	(0.048)
HISEI[a]												
	0.045	0.055	−0.048	0.141*	0.024	−0.044	−0.008	−0.054	0.062	0.004	−0.030	0.077
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)
Highest parental education (Ref. University admission [Fach-/Abitur])												
Lower secondary [quali. Hauptschule]	0.009	0.046	−0.035	0.105	0.050	0.034	−0.097	−0.171***	−0.069	−0.062	−0.084	0.011
	(0.033)	(0.029)	(0.029)	(0.028)	(0.011)	(0.038)	(0.027)	(0.053)	(0.048)	(0.074)	(0.073)	(0.085)

(continued)

Table A1 (continued)

Wave	2	3	4	5	6	7	8	9	10	11	12	13
Medium secondary [Mittlere Reife]	0.048	−0.068	−0.040	0.130*	−0.019	−0.086	-0.023	−0.079*	0.020	0.004	−0.021	0.079
	(0.022)	(0.024)	(0.018)	(0.022)	(0.015)	(0.035)	(0.015)	(0.039)	(0.028)	(0.046)	(0.044)	(0.054)
Migration background: Yes (Ref. No)												
	0.042	−0.097	−0.076	0.048	−0.016	−0.027	0.021	−0.092**	0.076	0.040	0.036	0.109*
	(0.015)	(0.029)	(0.029)	(0.019)	(0.013)	(0.032)	(0.016)	(0.039)	(0.025)	(0.050)	(0.049)	(0.058)
N	474	465	453	438	427	423	841	805	548	517	517	517

Note. Standardized linear beta coefficients; standard errors in parentheses. N refer to previous waves. [a] Highest International Socio-Economic Index of Occupational Status

[*] $p<0.05$, ** $p<.01$, *** $p<.001$

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Quality of Learning Environments in Early Childhood

Hans-Günther Rossbach, Sabine Blaurock, Christiane Grosse, Katharina Kluczniok, Susanne Kuger, Simone Lehrl and Wilfried Smidt

Abstract

Young children experience different learning environments in early childhood that influence their development in many ways. The following paper considers the quality of the family, preschool, and primary school early learning environments with a special focus on the process quality in these environments. What is innovative in this study is that it draws together three research literatures that are traditionally studied in isolation. By creating a shared lens for assessing environmental quality across different contexts, the BiKS study revealed the

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relevant factors that shape development over time at home and in (pre)school. First, an overview is given on the research instruments used in BiKS-3-18, followed by a description of the level and stability of quality within these environments over time. Next, the relations between process quality and structural conditions within these environments are presented. The paper ends with a discussion of the results. Some policy implications of the findings from BiKS are made throughout the paper, especially in the discussion.

Keywords

Preschool quality · Home learning environment · Instructional quality in primary school classes · Multimethod approach · Concepts of quality · Longitudinal study · Early childhood

1 Conceptual Framework and Research Questions

Growing up, children are confronted with stimulation from multitudinous sources. From the very beginning, interactions with their social and material surrounding stimulate their senses, provide learning impulses, and foster development. The BiKS-3-18 study favoured this very broad look at child development, starting with an overarching research question to identify environmental effects on child development (see e.g. Lehrl et al. this volume). Primary learning environments affecting early child development are the child's family, non-family based child care, in Germany most typically an age-heterogeneous preschool setting,[1] and later on primary school. A child experiences these learning

[1] At time of data collection, around 88 to 91% of children from age 3 to 6 were attending a preschool in the states of Hesse and Bavaria.

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environments concurrently (e.g. family and preschool) or consecutively (preschool and primary school). In past research, each learning environment has, in general, established its own field, resulting in different research frameworks that distinguish research regarding one learning environment from research on others. Such idiosyncrasies facilitate stand-alone research for each learning environment, and hamper research taking into account learning environments' interactions and mutual dependencies. One major research goal in BiKS-3-18 was to study different environmental contexts by creating a common assessment framework that balances generic aspects of learning environments and specific learning environment particularities.

Educational and social monitoring has developed an approach to categorize context factors for child development by applying an analogy of (economic) production of outcomes. Grouping relevant factors heuristically along this production line results in input factors, processes, output and outcomes (e.g. Purves 1987; Scheerens 1991). The BiKS-3-18 study applied this heuristic (see Fig. 1)

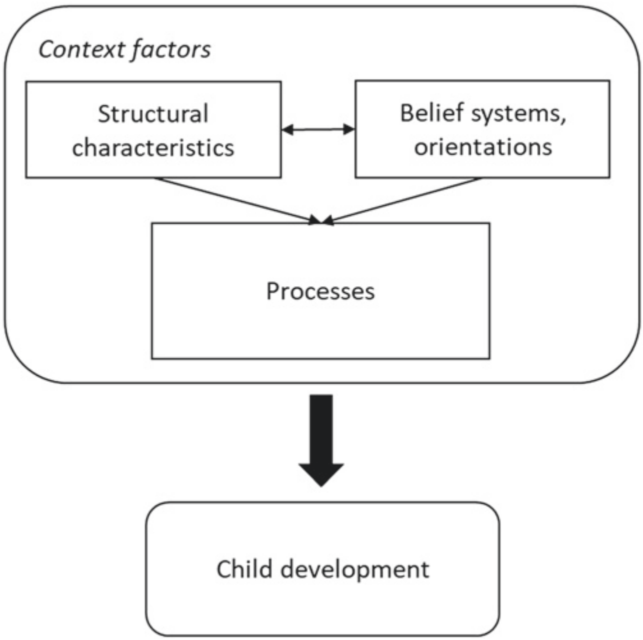

Fig. 1 Heuristic framework of educational quality in learning environments

to the learning environments of family, preschool, and primary school, categorizing context factors made up of inputs (i.e. conditions, structural characteristics of a learning environment) and processes (i.e. interactions between a child and the learning environments). Closely related to both are belief systems and orientations, relating to the values and beliefs of relevant stakeholders. Earlier research suggested that structural background characteristics and orientations shape and condition processes. The latter in turn directly affect child development, the output of interest (immediate results in certain developmental domains) and outcomes (greater life achievements), thereby mediating effects of the other two categories of factors (NICHD 2002). In addition, research has proven that beyond the dosage or quantity of a certain environmental factor, a setting's educational quality impacts child development (Anders 2013; Tietze et al. 1998; Tietze et al. 2005a). BiKS-3-18 therefore considered both the quantity and quality of stimulation in and across learning environments to be important for child development (see, for example, Anders et al. 2013). However, in the present paper, we will focus on the quality of stimulation.

Differentiating between certain outcomes, such as numeracy, literacy or socio-emotional development, leads to a differentiation on the learning environment side as well. Certain kinds of stimulation (e.g., reading with the child) may foster development in one domain (e.g., literacy) more strongly than in others (e.g., numeracy). Still other environmental factors may support development in different domains with equal strength. Consequentially, context factors that were assumed to target a broader range of output domains were labelled "global", those that targeted only a single domain were labelled "domain-specific". BiKS-3-18 studied global quality aspects as well as domain-specific facets of quality.

However, the heuristic framework should not be misunderstood in the sense that BiKS follows a simple model of teaching and learning in which the educational quality of an environment itself determines child development and learning. Development and learning not only depend on the quality of a learning environment, rather this provision has to be used by the children, which in turn depends on their individual cognitive, social, motivational and affective dispositions and abilities as well as their active role. Such a model of the supply of quality and use of quality has—in the German context—been proposed by, for example, Fend (1980) (see also Seidel and Reiss 2014, or Kiel 2018). Thus, the heuristic framework in Fig. 1 displays only one side—the environmental side—of effective learning of children. In analyses of effects on child development in BiKS-3-18, both sides are considered. In addition, the realized quality may also depend on child and family characteristics in the sense that the arrangement of quality adapts to the needs, motivations, socio-emotional and cognitive conditions of the children and their families (and their teachers). In this regard, children and families influence the arrangement of quality.

Research has emphasised the importance of process quality for developmental outcomes over other context factors (Anders et al. 2016). Therefore, BiKS-3-18 put a strong emphasis on researching the quality of educational processes. One concept that is common in international research on learning and instruction (Pianta and Hamre 2009; Praetorius et al. 2020) distinguishes three dimensions of process quality: student support, structuring and guiding the learning process, as well as students' cognitive activation and stimulation. We consider this differentiation of three dimensions as a general orientation for our conceptualisation of quality. Further on, children are clustered in classes, which leads to considerations on whether teachers target their educational approach towards a whole class or to individual children. Thus, individual children within the same classroom may experience different levels of quality. Process quality therefore has to be distinguished between quality related to the whole class and process quality related to individual children.

Applying this framework to each learning environment (i.e. family, preschool, and school), we follow two research questions in this paper:

- Research question 1: What are the levels of process quality across environments and do levels change over time?
- Research question 2: How is process quality influenced by structural characteristics and beliefs and orientations of the caregivers?

Before presenting and discussing results according to these research questions, the research instruments used, especially with regard to process quality, are introduced.

2 Research Instruments

The following paragraph illustrates the measures applied to answer our research questions. A complete overview of the used measures can be found in Homuth et al. (this volume). The longitudinal design of BiKS is described in more detail in von Maurice et al. (this volume, see Fig. 2).

Measurement of Quality in Preschools

In preschools, BiKS-3-18 measures the quality of educational processes at class level as well as at single child level in parallel, including global as well as domain-specific aspects. Each of the 97 preschool classes was observed in spring 2006, 2007 and 2008 to cover the entire preschool phase of the BiKS-3-18 children. To assess process quality at class level we used the German version of the Early Childhood Environment Rating Scale-Revised Edition (ECERS-R, Harms et al. 1998; KES-R, Tietze et al. 2005b) for global aspects and the German version of the Early Childhood Environment Rating Scale—Extension (ECERS-E, Sylva et al. 2006a, b; KES-E, Rossbach et al. 2018) for domain-specific aspects. Both observational instruments are high-inferential rating scales and were administrated by trained observers during one morning in preschools (four hours) at each measurement point. Compared to the focus on interactional aspects in the Classroom Assessment Scoring System (CLASS, Pianta et al. 2008), ECERS-R and ECERS-E put a stronger focus on the equipment and use of materials and—this is particularly true for the ECERS-E—on domain-specific aspects (Schmidt et al. 2018). Both instruments define environment in a broad sense and guide the observer to assess the arrangement of space, the materials and activities offered to the children, the supervision and interactions that occur in the classroom and the schedule for the day. Thus, the two instruments are specifically adaptable to the early childhood education practice in Germany, which is characterized by free play situations and open settings, whereas the CLASS instrument follows a more instructional educational approach. The ECERS-R consists of 43 items measuring global aspects of educational processes in seven domains (space and furnishings, personal care routines, language and reasoning, activities, interaction, program structure, and parents and staff). The ECERS-E extends the ECERS-R to give additional insights into 18 important domain-specific aspects of educational processes in four subscales (literacy, mathematics, science and environment, and diversity). The scores range from 1 to 7, with 1 indicating inadequate quality, 3 minimal quality, 5 good quality, and 7 excellent quality (see for more detail, Kuger and Kluczniok 2008). In the study, a four-day training course had to be completed by the observers successfully before using the observational scales. The observer agreement using 20 double coded observations of the KES-R measured by Cohens Kappa was $\kappa = 0.58$ and $\kappa = 0.44$ for KES-E indicating only lower inter-rater reliability. However, the percentage of agreement (within one scale point) between the two observers was 82% for the KES-R and 80% for the KES-E. The internal consistencies were satisfactory (Cronbach's Alpha for the KES-R total at the three measurement points ranged between $\alpha = 0.80$–0.87 and for the KES-E total score between $\alpha = 0.70$–0.73).

To assess process quality at single child level we developed a new instrument, called ZiKiB (target child observation, Kuger et al. 2006[2]; Smidt 2012). During the study preparation years (2004/2005), only few target child-related instruments were available (e.g., Emerging Academic Snapshot—EAS, Ritchie et al. 2001[3]; Observation of Activities in Preschools—OAP, Palacios and Lera 1995[4]; for an overview of target child-related instruments see Riedmeier 2019; Smidt 2012). Several years later, the inCLASS, another target child-related instrument, was introduced in the U.S. (Downer et al. 2010) and is now increasingly used in German-speaking countries as well (e.g., Kluczniok and Schmidt 2020; Smidt and Embacher 2021; von Suchodoletz et al. 2015). The ZiKiB is to some degree oriented to the ECERS-R and ECERS-E and the above-mentioned international instruments. It includes global and domain-specific aspects of quality ratings at target-child level, as well as a time sampling observation to document the daily activities of individual target children in preschool classes. Several areas are considered (e.g., activities of the target child, role of the preschool teacher). Moreover, the ZiKiB considers specific domains of support (e.g., of literacy- and numeracy-related abilities).[5] The observer agreement of the ZiKiB has been conducted in 20 preschools in Bavaria. Cohens Kappa ranged for different parts of quality ratings from $\kappa = 0.40$ to $\kappa = 0.81$, thus from low to good observer agreement (see in more detail Smidt 2012; Smidt and Rossbach 2016).

Furthermore, the preschool teachers completed questionnaires on structural characteristics of the whole preschool setting and the preschool class (e.g., class size, class composition), of the preschool teacher (e.g., teaching experiences, qualification) as well as on their educational beliefs (e.g., educational goals, beliefs about teaching and learning in preschools).

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[2] Einschätzskalen der Zielkindbeobachtung [Rating Scales of the Target Child Observation]. University of Bamberg, unpublished document.

[3] University of California, Los Angeles, unpublished document.

[4] University of Seville, unpublished document.

[5] The coding procedure assumes that, on a typical morning (8 a.m. to noon), two target children per preschool class were observed, each within three sets of 20 consecutive 1-min intervals. Every 20-min period was supplemented with a 10-min period for rating the educational quality of the preceding observation phase on a 7-point scale from 1 ("inadequate quality") to 7 ("excellent quality"). Once the whole 30-min period was completed for the first child, observers would then shift to the second child for the next 30-min period. This procedure was repeated three times.

Based on theoretical considerations from classroom research (Klieme et al. 2006), 28 items of both the ECERS-R/KES-R and ECERS-E/KES-E were—according to their content—assigned to three scales (Kuger and Kluczniok 2008): classroom management/climate (12 items, Cronbach's Alpha at the three measurement points: $\alpha = 0.63$–0.78), stimulation in literacy (9 items, $\alpha = 0.72$–0.78) and stimulation in numeracy (7 items, $\alpha = 0.66$–0.77). These three scales are taken up again when reporting the level and stability of quality and the relations between structural characteristics, educational beliefs, and educational processes. For the ZiKiB (Smidt 2012; Smidt and Rossbach 2016), we also refer to one global and two domain-specific scales: support of social competencies (Cronbach's Alpha at the three measurement points: 3 items, $\alpha = 0.63$–0.77), support of early literacy competencies (2 items, $\alpha = 0.53$–0.90), and support of early numeracy competencies (2 items, $\alpha = 0.30$–0.91). Again, some of the alphas are low. However, the small numbers of items have to be considered.[6] The application of the ZiKiB required a successful completion of a four-day training, during which the data collectors had to achieve an 80% agreement with a master rater (Smidt 2012, p. 68).

Measurement of Quality in Primary School Classes

Instructional quality in primary school classes was measured in the school years from 2009 to 2011/2012.[7] At that time and to the best of our knowledge, no existing observation instrument was available which could be readily used to capture instructional quality in German primary school classes. For this reason, 26 items from various studies (Clausen 2002; Helmke and Schrader 1998[8]; Rakoczy and Pauli 2006) were adopted for an observational instrument and partially adapted to measure global instructional quality in primary school classes. These items can be assigned to the model of the three basic dimensions of teaching quality (for an overview, Klieme et al. 2009; Praetorius et al. 2018). Items on global quality were rated on a 4-point scale (1 = strongly disagree – 4 = strongly agree) and grouped to form the scales classroom climate (6 items, Cronbach's Alpha at the

[6] The grouping of the items to the different scales had no intent to reproduce the CLASS domains emotional support, classroom organization or instructional support.

[7] Instructional quality was only measured at the class level and not at the individual child level.

[8] Unterrichtsbeobachtung durch externe Beobachter [Observation of instruction by external observers]. University of Koblenz-Landau, unpublished document.

different measurement points $\alpha = 0.44$–0.89), classroom management (6 items, $\alpha = 0.80$–0.90) and global cognitive activation (14 items, $\alpha = 0.84$–0.89). For analysing domain specific aspects of educational classroom processes another observational instrument was developed based on current teaching methodology and on the implementation of co-constructive instruction which refers to cognitive activation in mathematics (Steinweg 2011) and cognitive activation in literacy acquisition (Kammermeyer 2009[9]). The scale of cognitive activation in mathematics includes 5 items ($\alpha = 0.71$–0.83) and the scale of cognitive activation in literacy acquisition 4 items ($\alpha = 0.47$–0.63). The domain specific items were rated on a 7-point scale (1 = inadequate – 7 = excellent). All observation scales (global and domain specific) were assessed after having observed two or three lessons of a regular school day. Ratings on domain specific items were based on time periods in which topics of the particular subject were taught. Before using the observation scales, a three-day training course had to be completed successfully. Interrater reliability was tested in 22 double ratings. ICC_{unjust} assessed the observer's conformity for the different rating scales and ranged from 0.56 to 0.76 (classroom climate 0.56, classroom management 0.76, global cognitive activation 0.62, cognitive activation in mathematics 0.62, and cognitive activation in literacy acquisition 0.73). Again, the reliabilities of the scales range from low to good (see for more detail, Grosse et al. 2017).

The teachers additionally received questionnaires to capture structural characteristics of the teachers and classes (e.g. job experience, class size, proportion of students whose parents had a native language other than German) and educational beliefs (e.g. transmissive beliefs, constructivist beliefs).

Measurement of Quality in Families—Preschool Phase

Quality of stimulation within the family at preschool age was recorded annually in 2005, 2006, and 2007 based on a multi-method approach. The more global and quantitative aspects were surveyed with the German version of the Home Observation for Measurement of the Environment—Early Childhood (HOME-EC; Bradley and Caldwell 1984), which includes 55 items integrated in written and oral questionnaires as well as in observations. The HOME-EC was proven to capture the overall quality of stimulation within families with reliability and validity,

[9] Beobachtungsskalen für den Schriftspracherwerbsunterricht in der Grundschule [Rating scales for literacy acquisition in primary school]. University of Koblenz-Landau, unpublished document.

and differentiates especially for families at the lower end of the quality continuum (Bradley et al. 2001). In addition, to cover more domain specific aspects of stimulation within the family, the Family Rating Scale (FES-KiGa, Kuger et al. 2005[10]) was developed. FES is a live rating scale to assess a semi-standardised reading situation in a parent-child interaction in the home environment to record the quality of parental support behaviour. The picture books used within this situation were designed within the BiKS-3-18 study and thus unknown to the parents and the children. The parents were advised to share this book with their child as they usually do in joint picture book situations. A trained observer rated the quality of this interaction on 11 items measuring three dimensions: general language stimulation, stimulation of mathematics and stimulation in literacy. Each item is evaluated on 7-point-scales. The scale-levels 1 (low quality), 3 (minimal quality), 5 (high quality), and 7 (excellent quality) are qualitatively characterized and described to facilitate and standardize the evaluations. Beforehand, raters were trained to a criterion of 90% agreement (±1 scale point) to a gold standard of a master rating. Ten percent of observations were double coded by two independent raters (rater agreement $ICC = 0.78$). According to the overall-framework of the home learning environment, three cross-instrument scales were formed from the FES-KiGa and HOME-EC. Items addressing global stimulation were grouped under the scale social support (Cronbach's $\alpha = 0.47$) and domain-specific ones under the scales stimulation in literacy (Cronbach's $\alpha = 0.75$) and stimulation in numeracy (Cronbach's $\alpha = 0.71$). Since the individual items included in the scales have different anchors, the items were standardised and transformed in such a way that they assume a value range from 0 = low quality to 1 = excellent quality. Structural aspects of the family and parental beliefs and orientations were measured with questionnaires (see for more detail, Kluczniok et al. 2013; Lehrl 2018; Lehrl et al. 2020).

Measurement of Quality in Families—Primary School Age

Quality of stimulation within the family during primary school age was assessed annually in 2009, 2010, 2011 and 2012 (in each primary school year). The observations took place in those families who had participated since preschool age ("initial sample", Homuth et al. this volume). As in preschool age, the data collections are based on a multi-method approach. The HOME Inventory was again used to record the more global and quantitative aspects in primary-school

[10] Family Rating Scale—FES-KiGa, preschool age. University of Bamberg, unpublished document.

age (German version of the Home Observation for Measurement of the Environment—Middle Childhood, MC-HOME, Bradley and Caldwell 1984; Tietze et al. 2005a). The BiKS-3-18 study used 38 items of the 59 MC-HOME items and integrated them in written and oral questionnaires as well as in observations. A Family Rating Scale—FES-GS (BiKS Research Group 2009[11]) was developed analogous to the preschool age. A semi-standardized situation is initiated that evokes parental support behaviour in a kind of homework solving situation independent of curriculum, subject, and learning level. The BiKS-3-18 research group used the commercially available game "Rushhour" as a puzzle task to initiate a parent-child interaction. Trained observers rated 10 items, again on a 7-point-scale similar to the preschool phase. The 10 items of the live rating scale can be assigned to the basic dimensions of teaching quality according to Klieme and colleagues (2006): clarity of rules and structure, supportive teaching climate, and cognitive activation. The internal consistency of the overall scale is high across all survey time points (Cronbach's $\alpha = 0.87$–0.90, 10 items). The internal consistencies of the sub-scales turn out to be somewhat lower (scale clarity of rules and structure: $\alpha = 0.68$–0.80, 3 items; scale supportive teaching climate: $\alpha = 0.70$–0.79, 4 items; scale cognitive activation: $\alpha = 0.68$–0.78, 3 items). Furthermore, information on family background characteristics (e.g., educational attainment of parents, migration background, household composition and income), educational orientations (e.g., school-related expectations regarding the importance of certain support areas) as well as activities within the family (homework support of parents) and activities outside the family (e.g., leisure activities) of the children were asked annually via questionnaires.

As mentioned, some of the developed scales have rather low reliabilities. This limitation has to be kept in mind when stabilities (Sect. 3) and multiple regressions (Sect. 4) in the 97 preschools are analysed.

3 Level and Stability of Quality in the Different Learning Environments

The *first* research question relates to a description of the levels and stabilities of process quality children experience in their preschools, primary schools, and families during preschool and primary school age. How can the mean levels of

[11] Family Rating Scale—FES-GS, primary school age. University of Bamberg, unpublished document.

quality in preschool, primary school, and family be evaluated? How heterogeneous are children's experiences? Do children experience quality changes during their preschool years within learning environments? The following passages will concentrate on process quality as the more proximal aspects for the development of children. For structural characteristics and beliefs of the actors in the respective environments, only selected aspects are reported. First, the level of quality for preschools are reported, followed by the level of quality in primary schools as well as the level of quality in families at preschool and primary school age.

Levels and Stability of Quality in Preschool Classes

Table 1 displays descriptive statistics of the global and domain-specific aspects of process quality in preschools for the three measurement points at class and child level.

Overall, we find only moderate quality at the class level and at single child level in the 97 preschools under study (see Homuth et al. this volume, for the sampling procedure). The more global aspects of educational quality at *class level* ("classroom management/climate") as well as the original ECERS-R total scores are in the mid-range of the 7-point scale over the three preschool years with quite large differences between classes (standard deviations from 0.7–1.1). Thus, children experience quite different quality environments. Such medium (mediocre)

Table 1 Descriptive statistics of process quality in the 97 preschools

	M_{t1}	SD_{t1}	M_{t2}	SD_{t2}	M_{t3}	SD_{t3}
Process quality at class level[a]						
Classroom management/climate	3.7	0.7	3.8	0.6	3.9	0.6
Simulation in literacy	3.2	0.9	3.4	1.0	3.3	0.9
Stimulation in numeracy	2.5	1.1	2.6	1.0	2.9	1.1
ECERS-R total	3.7	0.7	3.8	0.6	3.9	0.6
ECERS-E total	2.8	0.7	3.1	0.7	3.2	0.7
Process quality at child level[a]						
Support of social competencies	4.7	0.8	4.3	0.9	4.7	1.0
Support of early literacy competencies	1.2	0.3	1.2	0.3	1.5	0.5
Support of early numeracy competencies	1.6	0.5	1.6	0.4	1.7	0.9

Note: [a] The scores range from 1 to 7 with 1 indicating inadequate quality, 3 minimal quality, 5 good quality and 7 excellent quality. $_{t1}$, $_{t2}$ and $_{t3}$ indicate the measurement points in spring 2006, 2007 and 2008 levels of process quality found here can also be found in other national and international studies. The global educational quality measured by the ECERS-R ranges between the means of 3.7 and 4.4 (LoCasale-Crouch et al. 2007; Sylva et al. 2006a, b; Tietze et al. 2013). Means above 5.0 (= good quality) are very rare in the BiKS-3-18 data ranging between 2 and 4% for the total score of the ECERS-R compared to 7% in the NUBBEK study (Nationale Untersuchung zur Bildung, Betreuung und Erziehung in der frühen Kindheit, Tietze et al. 2013).

The domain-specific quality in the BiKS-3-18 study is lower: “stimulation in literacy” and “stimulation in numeracy” as well as the domain-specific scale of the ECERS-E (total score), indicating minimal domain-specific quality with a slight increase over the three years of observation, possibly due to the introduction of educational plans (curricular guidelines) at that time in Bavaria and Hesse, which emphasize domain-specific stimulation. This result is in line with other national and international studies, such as NUBBEK ($M = 2.8$; Tietze et al. 2013) or The Effective Provision of Pre-School Education (EPPE) Project in England ($M = 3.1$; Sylva et al. 2006a, b), indicating a lower level of domain-specific quality compared to global quality. No preschool class in BiKS-3-18 reaches good or excellent values of domain-specific quality (values above 5 measured by ECERS-E). About 10 years later a study shows that the situation in German preschools is still very similar to the BiKS-3-18 data measured in spring 2006, 2007 and 2008 (Anders et al. 2021).

Table 1 shows that the global educational quality at *single child level* (“support of social competencies”) is at a moderate level in each of the three preschool years. By contrast, substantially different findings are revealed for the aspects “support of early literacy competencies” and “support of early numeracy competencies”. The overall pattern of results shows—comparable to the class level—fairly moderate quality in terms of the “support of social competencies” scale and rather inadequate quality in terms of the domain-specific scales “literacy” and “numeracy” over the entire preschool phase (Smidt and Rossbach 2016). It is difficult to compare these results with other studies, due to the lack of studies analysing the educational domain-specific quality at single child level.

Considering process quality, an overall picture emerges: Global process quality is only mediocre, domain-specific quality is even lower. Stimulation in mathematics is lower than in literacy. In all aspects, there is high variation between preschool classes. If process quality at the class level since the beginning of this century is compared to now, no general improvement of quality can be seen (see comparison in Tietze et al. 2013, p. 85). It could be speculated that new challenges for preschool (e.g., the introduction of educational curricula) may have interfered with efforts to improve quality.

In order to give a short impression on key structural characteristics that are of high political interest and therefore intensively discussed, three characteristics are presented for the first measurement point: The average class size (24.3 children, $SD = 3.6$) and the average staff-child ratio (12.4 children per teacher, $SD = 4.6$) are almost comparable to official statistics around the time of BiKS assessments (Bundesministerium für Familie, Senioren, Frauen und Jugend 2008). There are high variations in class size—ranging from 9 to 30 children—and teacher-child-ratio—ranging from a group with 4.5 children per preschool teacher to one with almost 28 children per teacher. On average, about a quarter of the children in the classes have a migration background (24.6%, defined by the mother tongue of the parents) with large differences between classes ($SD = 26.8\%$). They range from classes without children with a migration background to classes in which all children have a migration background.

On the one hand, the mean levels of process quality do not change much over the three measurement points from 2006 to 2008. On the other hand, it is possible that the quality of individual classes changes. The question of the stability of educational quality is relevant for politics and practice insofar as one could assume that only stable (high) quality has positive effects on children's development. However, the number of studies on this topic is rather low due to the lack of longitudinal studies measuring educational quality several times in the same class. With the BiKS-3-18 study, this question can be addressed. The stability of the educational quality at class level over the three preschool years is low to moderate, ranging between $r = 0.13$–0.48 and is highest on both domain-specific scales.[12] In sum, we find higher stability for the domain-specific quality aspects with lower quality level at the same time. Changes of quality do not only indicate measurement inaccuracy because the changes in the educational quality can partly be explained by changes to structural characteristics of the classes over the preschool years. Growth curve analyses using Bayesian estimation found that classroom composition characteristics (e.g., proportion of children with migration background in class, mean age of children in class) show the strongest relations to process quality in preschools (in terms of effect sizes), whereas allocated

[12] However, the BiKS-3-18 study has not yet examined aspects of interpersonal change and stability at the child level over the preschool years. In addition, for the class level only interpersonal change (rank order stability of difference) has been analysed. Analyses of intrapersonal change within classes have still to be done (see discussion).

Table 2 Descriptive statistics of instructional quality in primary schools[a]

	M_{t4}	SD_{t4}	M_{t5}	SD_{t5}	M_{t6}	SD_{t6}	M_{t7}	SD_{t7}
Global aspects of instructional quality								
Classroom climate[b]	3.5	0.5	3.6	0.5	3.6	0.5	3.7	0.3
Classroom management[b]	3.1	0.7	3.1	0.6	3.2	0.6	3.3	0.5
Global cognitive activation[b]	2.5	0.5	2.6	0.6	2.6	0.5	2.3	0.6
Domain specific aspects of instructional quality								
Cognitive activation in mathematics[c]	3.2	1.2	3.7	1.3	3.5	1.1	3.4	1.3
Cognitive activation in literacy acquisition[c]	2.6	1.1	2.9	1.1	3.1	1.0	2.5	1.0

Note: [a] t_4 to t_7 indicate the measurement points in 2009 (grade 1) to 2012 (grade 4). [b] The scores range from 1 to 4 with 1 indicating low quality and 4 high quality. [c] The scores range from 1 to 7 with 1 indicating inadequate quality, 3 minimal quality, 5 good quality and 7 excellent quality

resources and characteristics of the staff (e.g., teaching experience) are less strongly related to overall level and changes of quality (Kuger et al. 2016).[13]

Overall, these findings indicate a need for quality improvement in German preschools. This seems particularly relevant in light of the fact that high quality in particular has a positive effect on child development (e.g., Anders et al. 2012; Lehrl et al. this volume). Thus, in practice and politics, the focus should be on improving high-quality learning opportunities in preschools.

Levels and Stability of Instructional Quality in Primary Schools

The global aspects of instructional quality in primary schools across the years all range around values that can be classified as “good quality” (see Table 2). The rating of the scale classroom climate is, at all measurement points, higher than the rating of the scale classroom management and especially than the scale global cognitive activation. Results of other studies show inconclusive findings: The above results were also found in some other international studies (e.g. Cadima

[13] For analyzing the relations of quality to child development, we have not (yet) directly studied the effects of stability and change of quality on child development. Rather, we took the mean quality over the preschools years or selected according to the research question the quality of a specific year (see, e.g., Anders et al. 2012; Lehrl et al. this volume). Direct studies of the effects of stability could be a challenge for further analyses.

et al. 2010; Ponitz et al. 2009), in these studies, however, a different classroom observation instrument was used. Further studies, in which yet other classroom observation instruments are used, present a different picture (e.g. Lerkkanen et al. 2016; Pakarinen et al. 2014). The BiKS-3-18 study also considered domain specific aspects of instructional quality. The respective means are in mid to low range of the scale over the primary school classes. The rating of the scale of cognitive activation in mathematics ($M = 3.2–3.7$) is, at all measurement time points, in a higher range than the scale of cognitive activation in literacy acquisition ($M = 2.5–3.1$). Why this is so must remain open at this point. In addition, in all aspects of global and domain specific instructional quality we find a high variation; this is especially true for the domain specific aspects. As in preschool, the children experience very different instructional qualities in the primary school classes.

The importance of good instructional quality for children's learning was shown in many studies (e.g. Decristan et al. 2016; Lerkkanen et al. 2016; Pakarinen et al. 2011). However, studies that investigated stability of instructional quality in primary school classes over the primary school years are rare. The BiKS-3-18 study examines the stability of instructional quality and reveals low to medium stability ($r = –0.02–0.50$). Possible reasons for these lower correlations could be due to the specificity of instruction and the change of teachers over time, which occurred—especially in Bavarian primary schools—very often.

In order to give a short impression on key *structural characteristics and teacher beliefs* (at the first measurement point, grade 1), the mean class size is 22 children and the mean proportion of students whose parents have a native language other than German is 27%. Similar to characteristics of the preschool settings, the range here is very large, between 0 and 96%. Transmissive beliefs of teachers are lower ($M = 2.8$ in the 4-point scale) than constructivist beliefs ($M = 3.4$) (for results of selected structural characteristics and teacher beliefs in grade 2 see Grosse et al. 2017).

The results underline efforts in improving cognitive activation in mathematics and cognitive activation in literacy acquisition in primary schools. Especially because the domain cognitive activation in mathematics was shown to be predictive of children's mathematical growth in primary school (Lehrl et al. 2016). The importance of domain specific aspects of instructional quality for children's competencies at primary school age were also revealed by further studies (e.g. Fauth et al. 2014; Hanisch 2015). In addition, significant positive associations with later vocabulary status were shown for the global aspects of instructional quality, but not for the dimension cognitive activation in literacy (Grosse et al. 2017). These

Table 3 Descriptive statistics of process quality during preschool age

	M_{t1}	SD_{t1}	M_{t2}	SD_{t2}	M_{t3}	SD_{t3}
EC-Home total score	0.67	0.07	0.67	0.06	0.71	0.06
Global stimulation	0.76	0.13	0.73	0.14	0.73	0.15
Stimulation in literacy	0.51	0.13	0.52	0.15	0.53	0.16
Stimulation in numeracy	0.41	0.16	0.36	0.20	0.41	0.21

Note: All standardized scales range from 0 (theoretical minimum) to 1 (theoretical maximum)

findings emphasize the importance of considering global and domain specific aspects of instructional quality in primary schools.

Levels and Stability of Process Quality at Home During Preschool Age
Table 3 displays the descriptive statistics of the different aspects of process quality at home during preschool age (three measurement points, 2006, 2007, 2008).

Across the entire age range, stimulation in literacy and global stimulation is qualitatively higher than the quality of interaction regarding mathematical content. The global stimulation, which includes family social support, shows the highest means across the preschool period compared to literacy and mathematical stimulation. The overall quality of stimulation within the home learning environment (HLE) measured through the HOME is slightly above the theoretical mean of 0.5 across all measurement points and indicates moderate to good quality for most of the children within the BiKS study.

With regard to the overall level of informal language stimulation via contact with books (without table), the BiKS-3-18 study showed that informal language promotion through reading aloud and the provision of books is relatively high on average throughout the preschool period (Lehrl 2018). Nevertheless, it must be pointed out that at all measurement points there are children (around 10%) who own less than 10 (first preschool year) or less than 20 (second and third year) books on their own, and that almost 30% of the children are not read to daily. These children miss out on important experiences with language, writing and grammar in the years before they start school, which could be the reason for the increasing disparities in vocabulary and grammar acquisition, as found e.g. in Farkas and Beron (2004) and Weinert et al. (2010).

Examining changes in the home learning environment can provide important information about the dynamics in parent-child-interactions that foster young children during the preschool period as they approach school readiness. The level of change may vary across families due to their psychological, educational, or social resources (Son and Morrison 2010). Within the BiKS-3-18 study, the (interpersonal) stability of the educational quality of the home learning environment over the three preschool years is low to moderate, ranging between $r = 0.12$–0.54 and is highest on both the domain-specific scales. In comparison, the numeracy scale and especially the literacy scale have a higher stability across the survey points at preschool age ($r = 0.38$–0.43 and $r = 0.53$–0.54, respectively). In contrast, the relatively lower stability of the global stimulation indicates that children of preschool age have very different experiences from year to year with regard to global stimulations. Even if the levels of domain-specific stimulations are lower, parents seem to focus more consistently on stimulation of numeracy and literacy throughout the early years and before the start of school, whereas the general family stimulation processes are subject to more changes over the preschool period. We assume that parents may have consistent attitudes about the importance of domain-specific stimulation in the years before school starts.[14]

In order to give a short impression on key *structural characteristics* of the BiKS-3-18 families (first measurement point, beginning of preschool), 34% of the mothers have 12 to 13 years of school education (entrance certificate for university) and their weekly working hours amount on average to 11.3 h. There are, on average, two children in the families, and the mean socio-economic status of the families lay almost in the middle of the HISEI-scale ($M = 52.3$, $SD = 15.5$, scale from 16 to 90; Ganzeboom et al. 1992; see Homuth et al. this volume).

Levels and Stability of Quality at Home During Primary School Age

With regard to the stimulation in families during primary school age (see Table 4), the more global stimulation within the family at the beginning of primary school ($M_{t4} = 0.68$, $SD_{t4} = 0.14$; measured with the total score of the MC-HOME) is comparable to the level of stimulation at preschool age (measured with the total score of the EC-HOME). The mean scores of the more general quality aspects of the FES-GS consistently range from $M = 4.8$ to $M = 5.7$ on the 7-point scales in all four primary school years on the scales of clarity of rules and structure and supportive teaching climate. The cognitive activation scale ranges just under one scale point below this, indicating a lower level of quality. Again, we find large differences between the families (with a maximum of one standard

[14] We have not yet directly analyzed in what way changes are related to psychological, educational or social resources of the families. However, the data allows for such an analysis.

Table 4 Descritptive statistics of the MC-HOME and Family rating scale primary school age (FES-GS)[a]

	M_{t4}	SD_{t4}	M_{t5}	SD_{t5}	M_{t6}	SD_{t6}	M_{t7}	SD_{t7}
MC-HOME total score	0.68	0.14						
FES-GS, total scale and sub-scales								
Total scale[b]	4.7	0.8	4.8	0.8	5.0	0.7	4.9	0.7
Clarity of rules and structure[b]	5.4	1.0	5.5	0.9	5.7	0.9	5.5	0.9
Supportive teaching climate[b]	4.8	0.9	4.8	0.9	5.1	0.8	4.9	0.8
Cognitive activation[b]	4.0	0.9	4.2	0.9	4.4	0.8	4.2	0.9

Note: [a] t_4 to t_7 indicate the measurement points in 2009 (grade 1) to 2012 (grade 4). [b] The scores range from 1 to 7 with 1 indicating inadequate quality, 3 minimal quality, 5 good quality and 7 excellent quality

deviation) and, hence, the children experienced quite different learning environments in their families.

The means of the quality scale are quite similar across the four measurement points. If we look for (interpersonal) stability, the correlations are significant but relatively small: for the scale "supportive teaching climate" $r=0.16$–0.27; for the scale "clarity of rules and structure" $r=0.10$–0.23 and for the scale "supportive teaching climate" $r=0.21$–0.28. Even if the mean levels of quality are quite stable across the four years in primary school, children experience to some degree different (levels of) family stimulation from year to year. This suggests that parental stimulation varies notably between the primary school years.[15]

4 Relations Between Process Quality and Structural Conditions and Beliefs within Learning Environments

The *second* research question studies the mutual relationships between structural characteristics of learning environments and orientations and beliefs of the acting persons on one side and process quality on the other side. Especially in a political context it is, for example, often assumed that structural conditions of

[15] Again, we have not yet analyzed in what way changes are related to psychological, educational or social resources of the families.

preschools classes like class size, staff-child-ratio or teacher training are of high importance for educational processes. Referring to our framework model it is assumed that improvements in such structural conditions will lead to higher process quality and, following, to improvements in child development (see for example the discussions on the German federal law to improve quality in preschools, Bundesministerium für Familien, Senioren, Frauen and Jugend and Jugend- und Familienministerkonferenz 2016). Thus, an important research question is if these assumptions hold and how strong the respective influences are. In following these questions, the section restricts the analyses to the respective first measurement points in BiKS-3-18 study in preschool, primary school, and family during preschool and primary school age.

Conditions of Process Quality in Preschool Classes

First, the relations between process quality at the preschool class and the individual child level are reported. Referring to the first measurement point (i.e., first preschool year) findings from the BiKS-3-18 study show that the correlation between the total score of the ECERS-R and the total score of the ZiKiB is $r = 0.46$ and between the total score of the ECERS-E and the total score of the ZiKiB $r = 0.45$, respectively (Smidt 2012), indicating about 20% shared variance of both constructs. Referring to other instruments with different foci, Sabol et al. (2018) reported low correlations between the subscales of the CLASS and the inCLASS ($r = 0.02$ – $r = 0.24$). Thus, although the findings are varying, a separate consideration of both levels of educational quality (i.e., class level and single child level) can be supported in principle. This pattern of findings supports, in accordance with previous results, that both single child-related and class-related educational quality should be considered in order to obtain a comprehensive picture of the nature of the educational processes in preschools.

As already stated, an important question for policymakers is to know which structural characteristics and educational beliefs of preschool teachers are associated with process quality and to what degree. Several studies have found (mainly moderate) correlations between process quality, structural characteristics, and educational beliefs of preschool teachers (Pianta et al. 2005; Slot 2018; Tietze et al. 2013) yielding evidence of a complex interaction of structural characteristics that jointly predict process quality. For *process quality at the class level*, the following relationship pattern at measurement point 1 emerged (see Table 5; for more details see Kuger and Kluczniok 2008). The selection of the reported

Table 5 Results of multiple regression analyses: preschool class-level, first preschool year

	Global quality	Domain-specific quality	
	Classroom management/climate	Literacy stimulation	Numeracy stimulation
Class size	−0.21+	−0.19+	−0.01
Staff-child ratio	−0.10	−0.04	−0.10
Mean age of children in class	0.25*	0.24*	0.23*
Percentage of children with migration background in class	−0.26*	−0.33*	−0.24*
Job satisfaction	0.22*	0.15	0.15
Years of job experience	−0.23*	−0.07	−0.07
Conservative attitudes	−0.12	−0.21*	−0.14
Cooperative attitudes towards learning	0.10	0.35***	0.11
R^2 (R^2 adjusted)	0.27** (0.17)	0.32** (0.23)	0.28** (0.18)

* Note: Beta-coefficients are displayed; controlling for space per child and federal state. + $p<0.10$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

predictors in the models was oriented towards predictive variables in other comparable analyses (see Mashburn et al. 2008).[16]

In general, the explained variance is less than a third of the total variance in the process quality, indicating only moderate relations between the set of these predictors and the process quality. We find a significantly lower process quality concerning global as well as domain-specific quality in preschool classes with more children with migration background, in classes with a younger mean age of the children, and in smaller classes. It is noticeable that in this set of predictors

[16] For this analysis, only the mean age of the children in class was used (Kuger and Kluczniok 2008) and not the exact age composition. This limits the interpretation since class size and staff-child-ratio may depend on the age composition. Class size and staff-child-ratio have only a low correlation $r=.21$, i.e., when class size increases, there is only a smaller increase of the number of children per staff member. Job satisfaction, years of experience and attitudes are related to the main teacher in the class in case there are more teachers in the class.

the staff-child ratio has hardly any significance for the process quality. In addition, educational beliefs of preschool teachers are also related to process quality. Classes with teachers with more cooperative attitudes towards learning and lower conservative goals in education achieve a higher quality in literacy stimulation. The less satisfied the preschool teacher is with his or her job and the more years of job experience he or she has, the worse the global quality. The latter result may be a cautious indication of burnout tendencies among preschool teachers.

We want to highlight the result that quality is lower in smaller classes when the staff-child-ratio is controlled, a result that was also found some years later in the NUBBEK-study (Tietze et al. 2013). In that case, smaller classes do not seem to increase quality. The finding that quality is lower when the mean age of the children in a class is lower may indicate that the concept of preschool classes—as it is measured with our quality instruments—is more related to older children in the age range 3 to 6 and that in younger classes care aspects are more emphasised than educational aspects. The negative relation of quality to the percentage of children with migration background—which was also found in other studies (see, e.g., the NUBBEK-study, Tietze et al. 2013)—indicates more challenges in such classes which are not always met.[17] However, more detailed analyses are necessary to describe the relationship more precisely (e.g. curvilinear relations). In sum, these findings point to the need for targeted approaches (with additional resources) for specific groups of children, e.g., language education for disadvantaged children and concepts for younger age groups in preschool classes. In this context, approaches that combine targeted approaches for specific children in the daily preschool routines could be promising (Leseman and Slot 2020). The negative relation between the percentage of children with migration background in classes and process quality is striking for Germany (and other countries) in that it is not found in other early childhood education systems that implemented specific interventions for disadvantaged children in preschools. For example, in the Netherlands or UK we find the opposite effect, according to which the process quality is better in classes with more children with migration background (Slot et al. 2015). For Germany, some federal states now provide additional funding for staff positions in disadvantaged social areas (particularly in the context of the "Gute-Kita-Gesetz", e.g., Rhineland-Palatinate, Saxony-Anhalt) to compensate for the

[17] Informal discussions with some teacher yielded that this negative relation may be due to the feeling of the teachers that with increasing percentage of children with migration background they cannot follow their educational tasks but are distracted by special care needs of this children.

challenging conditions of these settings. Currently, it remains to be seen how this additional funding will influence the preschool quality today. The findings for Germany appear to be particularly important because further analyses by Lehrl et al. (2014) show that children with migration background bear a lower chance of attending high quality settings (similar to Becker 2012), whereas comparable effects cannot be found for children in families with lower educational or less advantaged economic backgrounds. Summing up across global and domain-specific indicators of process quality, the most influential variables in BiKS seemed to be those of classroom composition; less important were allocated resources and least influential proved to be characteristics of the professional staff in the classroom.

The relations between structural characteristics, educational beliefs, and domain-specific *processes at single child level* are small (without table, see in more detail Smidt 2012). For the support of social competencies, for example, child-related variables (gender, migration background) and class size had no significant effects. The quality of support of social competencies is higher the fewer years of experience the teacher has. In addition, the support of social competencies is somewhat better for children whose teachers show a higher understanding of her role as hierarchical (i.e., seeing herself/himself as an expert, advisor, and authority towards children). The quality and quantity of materials in the preschool class positively relate to support of social competencies. In addition, Linberg and Kluczniok (2020) report that language- and math-related processes are associated not only with classic structural characteristics (e.g. job experiences), but also with individual child characteristics (e.g. shyness) and that math-related processes are related to math competencies shortly before school entry. Due to the limited comparability with other findings more research is needed particularly on issues about predictors of educational quality at single child level. That child characteristics may have a significant influence on interaction quality is shown by recent studies that assessed interaction quality with the inCLASS (e.g., children's language skills, Smidt and Embacher 2020; children's personality, Smidt and Embacher 2023). Taken together, the survey of interaction quality at the child level may well represent a research benefit.

Conditions of Instructional Quality in Primary School Classes

Relations between educational processes, structural characteristics, and educational beliefs of the teachers in grade 1 of primary school are depicted in table 6. The selection of the variables was based on structural characteristics and educational beliefs of the teachers that have been shown to be relevant for instructional quality in primary school (cf. e.g. for individual structural characteristics NICHD

Table 6 Results of multiple regression analysis: primary school class-level, grade 1

	Classroom climate	Classroom management	Global cognitive activation	Cognitive activation in literacy acquisition
Transmissive beliefs	0.10	0.14	−0.21*	−0.20+
Constructivist beliefs	0.01	0.08	0.03	−0.07
Job experience of the teacher in number of years	−0.26*	−0.24*	−0.22+	−0.06
Job satisfaction	0.18+	0.06	−0.06	−018
Number of weekly lessons the teacher teaches in the class	0.16	0.03	0.13	0.18
Percentage of students with migration background in class	−0.14	−0.06	−0.22+	−0.12
Class size	−0.08	−0.08	−0.20+	−0.16
Teachers performance assessment of the class	0.01	0.16	−0.01	0.11
Federal state (Bavaria = 0; Hesse = 1)	−0.25*	−0.36**	0.03	0.25*
R^2 (R^2 adjusted)	0.22** (0.17)	0.20 ** (0.14)	0.22** (0.16)	0.18* (0.12)

Note. Standardized coefficients are shown. + $p<0.10$; * $p<0.05$; ** $p<0.01$; *** $p<0.001$

ECCRN 2004; Tietze et al. 2005a)—supplemented by findings from the secondary school instruction. Only a small part of the total variance is explained by the total set of predictors. This result that structural conditions and teacher beliefs are not striking predictors is in line with other studies (e.g. Tietze et al. 2005a).

In the first year of primary school, teachers with more transmissive beliefs display a lower global cognitive activation and a lower cognitive activation in literacy acquisition. The results—not yet published—show that the educational beliefs of teachers regarding the design of lessons are manifested in the processes that actually take place. More years of job experience are related with lower global instructional quality in grade 1 when job satisfaction is controlled. The extent to which the date of training or of first trends of burnout are evident in this context must remain open at this point. In addition, a negative association can be seen between the proportion of students whose parents have a native language other than German and global cognitive activation (significant at a 10% level). However, compared to results on quality in the preschool classes, the negative associations between the proportion of students with migration background and quality are much lower and less consistent. This may relate to the fact that schooling is more regulated than preschool education. Another result is the unexpected finding of quality differences between the two federal states for the first school year. The extent to which the differences in quality can be attributed to different training contents in teacher training, to different structural conditions at the teachers' workplace, or in the classes cannot be answered at that time.

Conditions of Quality in the Family at Preschool Age

When turning the focus to the home learning environment (HLE) at preschool age, several studies showed that different structural characteristics of the family are related to different aspects of the HLE (e.g. Bradley et al. 2001; Tietze et al. 1998). Typical predictors are the socio-economic status, maternal education, income of the family, the language background of the family, and the number of siblings in the household, as well as educational beliefs (see Lehrl 2018, for an overview). However, a systematic investigation of different facets of HLE, as conceptualised in the BiKS-3-18 study, including a broad selection of structural and belief characteristics on a personal, social, and spatial-material level has not yet been taken into account. Table 7 displays the results from the first measurement point of the BiKS-3-18 study.

The results show that higher maternal education and the family's ability to afford to enrol their child in extracurricular activities go along with better overall or global family support in preschool age. Moreover, literacy stimulation is better in families without migration background, who have a higher socioeconomic status, higher maternal education, higher income, higher expenses for activities, and higher educational orientations. Promotion of numeracy was associated with migrant status, higher SES and educational school-oriented beliefs. When examining explained variance, general aspects of the home learning environment (global stimulation) seem to be relatively independent of structural characteristics and parental educational beliefs. Domain-specific aspects of the home learning environment, on the other hand, are more strongly related to structural characteristics and educational beliefs. Literacy stimulation is more dependent on the structural characteristics, whereas stimulation in numeracy is more dependent on parental beliefs towards education.

Overall, it can be stated that the variation in the HLE at the age of 3 can be predicted differently depending on the dimension under consideration, and that it is therefore not possible to speak of families as "the" promoters or "the" non-

Table 7 Results of multiple regression analysis: HLE, first preschool year

	Global stimulation	Stimulation in literacy	Stimulation in numeracy
Age of child (in months)	0.03	−0.01	−0.12*
Migration background (ref.: no migration)	−0.07	−0.28***	−0.29***
SES	−0.01	0.13*	0.18**
Maternal education	0.22**	0.25***	0.08
Age at entry to nonparental-care	−0.07	−0.08	−0.01
Number of children	−0.03	0.01	−0.03
Netto equivalent income (in Euro)	0.05	0.15**	−0.09
Expenses for activities (in Euro)	0.13*	0.16**	0.05
Beliefs: fundamental promotion	−0.01	0.12*	0.09+
Beliefs: preparation for school	0.00	0.13*	0.35***
R^2 (R^2 adjusted)	0.13*** (0.09)	0.40*** (0.37)	0.26*** (0.22)

Note. Standardized coefficients are shown. $^+ p<0.10$; * $p<0.05$; ** $p<0.01$; ***$p<0.001$

promoters. It is nevertheless apparent that children from socially disadvantaged families have fewer language, literacy, and mathematical experiences, suggesting that children from less privileged households are at more developmental risk than their more privileged peers.

Conditions of Quality in the Family at Primary School Age

At the beginning of the primary school years in grade 1, we find almost no relation between family stimulation quality (total score of FES-GS) and socio-structural factors (e.g., parents' school education, income, migration background, parental aspiration; without table, adjusted $R^2=0.02$). In the second to fourth year of primary school, the educational level of the parents becomes somewhat more important. The higher the parents' level of education, the higher the quality of stimulation in the family. The migration background does not play a role at any time. At all measurement points, the explained variances are low ($R^2<0.10$).

These results are somewhat unexpected and striking, and maybe related to our rather global operationalisation of family quality. It could be that quality that is more related to school-based parental involvement is more dependent on structural conditions of the family and parental beliefs, but results are still to be produced.

5 Discussion

The focus of this section will not be on an integration of the results into the research literature. This has already been done in the preceding sections. Rather, we will highlight some results concerning quality in the different learning environments and their importance. For some of the implications, two general limitations have to be considered:

- The study included only two German federal states, Bavaria and Hesse. Thus, the results may not be representative of all German states.
- The analysed data was collected 2006 to 2008 in the preschool phase and 2009 to 2012 in the primary school phase. Since there have been many developments and reforms in preschools and primary schools since then, the current situation may have changed. Therefore, (political) implications have to be considered with caution. In any case, a current replication of the study, in which recent developments—e.g. new measures of educational quality—are considered, is needed.

BiKS managed to establish an integrative concept of quality assessment across children's primary learning environments, family, preschool, and school. The starting point of this project in the BiKS-3-18 study was the development of an integrative concept for recording the educational quality of the early learning environments of preschool, primary school, and family to allow for a more rigorous analysis of the interrelation of the quality a child experiences in different environments during early childhood. Against this background, a broad set of research instruments was selected and justified. In addition, we developed new instruments like the ZiKiB for measuring preschool quality at the child level, an observational tool for measuring domain-specific quality in primary school classes and a semi-structured tool for measuring domain-specific quality in families in preschool and primary school age (Family Rating Scale). All instruments have proved their worth and can be applied in other studies and this has been done with the (shortened version) of the ZiKiB in a study concerning the interaction quality at target child level in Austria (Smidt and Embacher 2020) and Germany (Kluczniok and Schmidt 2021).

Process quality in families, preschool settings, and primary classes are low to mediocre, with lower levels for domain-specific quality than for more global aspects. Process quality in preschool classes, in primary school classes, and in the family show high variation. Thus, the children experience not uniform quality but differing opportunities for their development. In the preschool classes, we find only low to mediocre global process quality. This was also found in other studies in the last 20 years, showing that the mean quality level has not changed over time despite many efforts towards improvements in Germany. Domain-specific quality is even lower than global quality. It is expected that domain-specific quality will increase over time because of the political discussions following large-scale national and international studies to measure competencies in schools and the introduction of curricula in preschools in all German states that emphasize domain-specific stimulation. However, further efforts to improve global and domain-specific process quality are needed. Currently, several programmes for quality improvement are implemented in Germany. We would only like to mention the nationwide federal large-scale programme "Sprach-Kitas"—Language Day Care Centres.[18] Our study is one of the first in Germany that observes domain-specific instructional quality (especially for the stimulation of mathematics) in the beginning of the primary school phase. One result is that the domain-specific stimulation in primary school classes (cognitive activation in mathematics and in literacy acquisition) is rather low. Thus, challenges exist for improvements. It has to be kept in mind that all observational quality rating instruments were developed by experts in the field. The verbalization of scale values, such as "good" or "poor" quality thus represents the research consensus e.g. in didactics of elementary mathseducation or early childhood education on what is understood to be good or poor quality in a normative sense.

For process quality in the family, in preschool, and primary school age, high heterogeneity has been found, again pointing to very different learning opportunities for young children. Interestingly for the preschool age, domain-specific quality during shared book reading is quite high in language stimulation compared to stimulation in mathematics. However, results of the frequencies of domain-specific stimulation in the family in the two domains are reversed. Namely, the frequencies of stimulation in mathematics is higher than in literacy,

[18] https://sprach-kitas.fruehe-chancen.de/

but the quality of stimulation is lower in mathematics than in literacy. This result needs further analyses. In addition, global stimulation of the children across the preschool time is less stable than domain-specific stimulation. This points to quite stable orientations of the parents in the two domains whereas global stimulation seems to be less stable across the preschool time, probably depending on the specific situations. For stimulation in the family during primary school age, it is somewhat surprising that the clarity of rules and structure are assessed as good across the primary school time, whereas the quality of cognitive activation is just medium. Consequences for family education have still to be discussed, but it seems that parents should be further encouraged in their role as cognitive activators.

Process quality is only weakly related to structural conditions and orientations of the stakeholder. In detail, the relations of structural conditions in the different environments and orientations and beliefs of the actors on one side and the process quality on the other side have been analysed. A first impression is that the predictions of process quality by structural aspects and beliefs are small. This relates to all analysed environments. For example, only about 30% of the total variance in scales on process quality are explained by structural aspects and beliefs in preschool classes and only a fifth in primary school classes. In other words, the level of quality realized in settings is only weakly related to structural conditions and beliefs. Consequently, changes, for example in preschools' structural conditions like class size or staff-child-ratio, will have only limited effects for quality improvements. Other means than changing structural conditions for improvement are needed (see above). Whereas quality of stimulation in the families in the primary school age is almost independent of the studied structural conditions (with the exception of the migration background of the family) and beliefs of the parents, some interesting results emerge for the preschool phase. Stimulation in literacy and numeracy is lower in families with migration background and in families with lower SES, but there are no differences for these families in global stimulation. Maternal education is positively related to global stimulation and stimulation in literacy, but there is no relation to stimulation in numeracy. Depending on the quality dimension considered, we find different important predictors. We do not find parents to be "the" promotors or "the" non-promotors of quality (even if we find that children in socially disadvantaged families have fewer informal language experiences and receive lower quality of language input). These differential relations are important for both further research and considerations on practical improvements. One result especially found for preschool classes is the negative relation between the proportion of children with migration background at the class level and process quality for global and domain-specific quality. This is in no case natural and inevitable, but seems to be—see the contrary relation in England and the Netherlands—a result of our pedagogical approaches which focus more on stimulation of all children in daily routines in preschool and less on—additional—special enrichment for special groups of disadvantaged children.

There are two further areas of research results that were not included in this section. First, there are analyses of the relations of levels of quality the children experience in preschool, primary school, and family with the development of children in different domains (see Lehrl et al. this volume). Second, there is some research on the interrelatedness of levels of quality between environments as well as between institutional or family environment(s) across time (e.g. the relations between characteristics of the family and quality in preschool, Lehrl et al. 2014, or the interplay between experiences in family and preschool during preschool age and reading in primary school age, Lehrl and Kuger 2013). Due to limitations in length, they were not included in this section.

The BiKS-3-18 data for the quality in preschools, primary schools, and families form a rich data set for further analyses and also for other research groups. Summing up the most needed further analyses, we mention some selected directions: analyses of intrapersonal stability of quality experiences, more analyses of the level of quality in primary school, analyses of preschool quality at the child level and stability over time, analyses of the relations of change and stability of quality in the family to psychological, educational and social resources of the family and analyses of the interrelations of quality between the learning environments.

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Developmental Dynamics and Social Disparities in Early Education-Related Child Development: Results from the BiKS-3-18 Study

Sabine Weinert and Susanne Ebert

Abstract

The development of domain-specific competencies and the emergence of social disparities start well before school entry. These early developments have been suggested to be highly relevant to later developments, educational pathways, and participation in society. Longitudinal large-scale studies, in particular, provide important insights into relevant individual preconditions, developmental trajectories, and their relation to learning opportunities in different learning environments. Against this background, this paper presents selected results of the longitudinal and interdisciplinary study BiKS-3-18 with a special focus on education-related facets of child development at preschool age, their interrelations, predictive impact, and connection to environmental conditions. In particular, we (1) present results on early emerging individual differences between children, their stability over time, and their relation to children's socioeconomic family background (SES). (2) With a special focus on language development, we address the impact of child characteristics and the dynamics of early child development by presenting findings (a) on changing developmental relations between working memory and language acquisition and (b) on the interrelations between early child language and children's

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social-cognitive, metacognitive, and social-emotional development. (3) Finally, we report findings on the importance of individual differences and SES-related disparities, particularly in the language domain, for later school-related language competencies and school performance.

Keywords

Early child development · Individual differences · SES-related disparities · Dynamic relations between developmental domains · Impact of language on school-relevant competencies and school grades

1 Introduction

The development of domain-specific competencies and the emergence of social disparities start well before school entry (Brooks-Gunn and Duncan 1997; Halle et al. 2009; Hansen and Joshi 2007; Weinert et al. 2017). These early developments have been suggested to be highly relevant to later developments, educational pathways, and participation in society (Heckman 2013; Noble et al. 2007). Bioecological models of child development highlight the significant role of children's developing prerequisites and their interaction with proximal and more distal environmental conditions (Bronfenbrenner and Morris 2006). Longitudinal large-scale studies, in particular, provide important insights into relevant individual preconditions, developmental trajectories, and their relation to learning opportunities in different learning environments. Moreover, they enable research on the significance of early experiences and developments for children's future development and educational pathways (see Hachul et al. 2019). Against this background, this paper presents selected results of the longitudinal and interdisciplinary study BiKS-3-18 with a focus on education-related facets of child development at preschool age, their interrelations, predictive impact, and connection to environmental conditions. Thereby, special attention is paid to child language as a particularly important developmental domain with high impact on other educationally relevant developments as well as on later learning at school.

The BiKS-3-18 study was designed and conducted by the research unit "Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age" (BiKS).[1] It started when children were

[1] The research unit BiKS was funded by the German Research Foundation. This paper summarizes selected results drawing mainly on data that were conceptualized and collected within the framework developed by BiKS Project 3 (developmental psychology; grant to

on average 3 years of age tracing their development until the end of primary school at about ten years. Two subsequent projects continued and expanded the study by following the students and their families beyond primary school into adolescence.[2]

Overview of the Main Issues Addressed in the Present Paper

Contrary to overarching developmental theories, child development has been shown to be rather domain-specific, i.e., different domains of development place different demands on children, which they master more or less easily. Thus, a child might be advanced in one area of development but less so in another, leading to domain-specific developmental differences within an individual; likewise, interindividual differences and developmental trajectories have been suggested to be domain-specific. From a psychological perspective, investigating the stability and change of these developments is of high relevance. For instance, important questions are: To what extent do early domain-specific differences (e.g., in the language domain) predict later differences in the same domain? Do early differences in one domain (e.g., in language) impact on the progress and developmental trajectories in other developmental domains (e.g., social-emotional development)? Besides these internal, possibly dynamic mechanisms of child development, bioecological models highlight their interaction with environmental conditions. In particular, the 'Specificity Principle' suggests specific environmental conditions to impact on specific developments in specific individuals and at specific time-points in development (Bornstein 2017, 2019a, b). Furthermore, theoretical accounts of domain-specific development propose that some developments at some time-points might be more prone to environmental influences and stimulating processes than others; e.g., nativistic theories of language acquisition imply less environmental impact on early grammar than on early vocabulary (e.g., Chomsky 1981; Fodor 1983; Pinker 1994; Van der Lely and Pinker 2014; Vasilyeva and Waterfall 2011).

S. Weinert; WE 1478/4–1 to 4–4) and affiliated PhD-projects (e.g., Dubowy 2010; Ebert 2011) in collaboration with the research unit's framework project and the other BiKS projects.

[2]The follow-up study BiKS*plus*-3-13 was funded by the German Research Foundation (grants to S. Weinert, H-G. Rossbach, and G. Faust; WE 1478/8–1; FA 650/3–1; RO 820/15–1); the BiKSplus-3-18 follow-up study was funded by the German Ministry of Education and Research (grant Nr: B8578).

The present paper addresses those issues by drawing on data from the BiKS-3-18 study and particularly on the measurements conceptualized within the developmental psychology project (BiKS Project 3). In particular, we focus on children's education-related domain-general and domain-specific development during preschool years and beyond and on the dynamic interrelations between their developmental trajectories as internal conditions of child development. Thereby, special attention is given to child language and its relation to other developments as well as to family background and thus to the early emergence of SES-related disparities in child development. Beforehand, we will give an overview of the BiKS-3-18 study with a focus on the framework and design of the longitudinal assessments of domain-general (e.g., working memory, nonverbal reasoning, speed of information processing) and domain-specific facets (e.g., mathematics, language, factual content knowledge) of child development. Thereafter we present selected results on developments in these areas. In particular, we report on the stability of individual differences over time, and on interrelations between different areas of development with a special focus on the relation between child language and other areas of development, including social-cognitive and social-emotional development. Furthermore, we present results of the BiKS-3-18 study on relations to later school-related, so called "academic" language competencies and school grades. Thereby we also address the predictive impact of early disparities related to family background on these outcomes.

2 The BiKS-3-18 Study and the Longitudinal Assessments of Education-Related Facets of Child Development

2.1 General Outline of the Design, Sampling, and Assessments of the BiKS-3-18 Study

The design of the BiKS-3-18 study draws on the assumptions of bioecological models of development (e.g., Bronfenbrenner and Morris 2006). According to these models, internal factors in the sense of individual resources, developmental trajectories, and relations between different developmental domains interact with educational processes and environmental conditions in the family and in (educational) institutions to produce developmental changes. These are influenced by more distal factors such as the families' socioeconomic status (SES; e.g., parental education, occupation, and family income) and are embedded and indirectly influenced by broader cultural and societal contexts.

Against this background, the BiKS-3-18 study followed approximately 550 children from 97 preschools in Bavaria and Hesse longitudinally

- with age-appropriate standardized tests on their development in the (meta)cognitive and language area;
- with (partially semi-standardized) observations in the children's homes and educational institutions as well as
- with questionnaires and computer-assisted interviews given to parents and to relevant context persons in preschools and, later-on, schools and to the children themselves (see Homuth et al. this volume).

Assessments started shortly after the children had entered preschool at the age of approximately 3 years in 2005 with annual, sometimes semiannual measurement points (survey waves) until the age of 13 and a follow-up online survey at the age of about 18 years in 2020. The standardized tests cover a broad range of facets of the children's domain-general (e.g., working memory, nonverbal reasoning, speed of information processing) and domain-specific (e.g., mathematics, language, factual content knowledge) development. In addition, aspects of social-emotional and personality development as well as of the development of self-regulation were assessed from a multi-informant perspective by parents' and (pre)school teachers' judgements and, later on, also via self-evaluation. Another important feature of the BiKS-3-18 study is a detailed assessment and recording of global and domain-specific environmental stimulation, covering proximal process characteristics and more distal structural characteristics of preschools, schools, and the children's homes (see Rossbach et al. this volume). Special attention was paid to the assessment of indicators of the socioeconomic, educational, and language characteristics of the children's families.

The sampling procedure aimed at including a broad range of child, family, and institutional characteristics (see Homuth et al. this volume) and allowed for tracking the children's development from early preschool through primary school and beyond. The 550 children from 97 selected preschools were scheduled to regularly start formal schooling in fall 2008. Upon entry into school, the classmates of the "BiKS children" were also invited to take part in the study, so that the sample increased to about 1000 children (see Homuth et al. this volume for a more in-depth description of the sample across assessment waves). Beyond primary school, the children (and their parents) were tracked individually and later on (last wave in 2020) mostly via an online survey.

Measurements of domain-general and domain-specific facets of child development and in-depth assessments of environmental factors. Tables 1, 2, and 3

Table 1 BiKS-3-18: Assessments of facets of child development in the cognitive, language, and metacognitive area in preschool

	1. MP autumn 2005	2. MP spring 2006	3. MP autumn 2006	4. MP spring 2007	5. MP autumn 2007	6. MP spring 2008
	Mean age 3;9 years	Mean age 4;0 years	Mean age 4;8 years	Mean age 5;0 years	Mean age 5;7 years	Mean age 6;1 years
	all children (97 preschools)	subgroup (44 preschools)	all children (97 preschools)	subgroup (44 preschools)	all children (97 preschools)	all children (97 preschools)
Language:						
Vocabulary, receptive	PPVT-R (research version)		PPVT-R (research version)		PPVT-R (research version)	
Vocabulary, productive	Riddle (K-ABC)					
Grammar, receptive	Sentence comprehension (SETK3-5)	TROG-D (shortened)	TROG-D (shortened)	TROG-D (shortened)	TROG-D (shortened)	TROG-D (shortend)
Sentence production	Encoding of semantic relations/ picture description (SETK 3–5)		Encoding of semantic relations (SETK 3–5)		Encoding of semantic relations (SETK 3–5)	
Morphology	Plural formation (SETK 3–5)					
Listening Comprehension, text-level		Story comprehension (Wimmer 1982)[1]		Story comprehension (Wimmer 1982)[1]		

(continued)

Table 1 (continued)

	1. MP autumn 2005	2. MP spring 2006	3. MP autumn 2006	4. MP spring 2007	5. MP autumn 2007	6. MP spring 2008
	Mean age 3;9 years	Mean age 4;0 years	Mean age 4;8 years	Mean age 5;0 years	Mean age 5;7 years	Mean age 6;1 years
Working Memory, Speed of Information Processing:						
Phonological loop	Nonword repetition (SETK 3–5)		Nonword repetition (SETK 3–5)		Nonword repetition (SETK 3–5)	
Memory span	Digit span (K-ABC)	Digit span (K-ABC)	Digit Span (K-ABC)	Digit span (K-ABC)	Digit span (K-ABC)	
Nonverbal memory span	Hand Movements (K-ABC)		Hand Movements (K-ABC)		Hand Movements (K-ABC)	
Speed of Information Processing	Item identification speed (fast word repetition)	–	Rapid automatized naming (RAN; Denckla and Rudel 1976)	Rapid automatized naming (RAN; Denckla and Rudel 1976)	Rapid automatized naming (RAN; Denckla and Rudel 1976)	Rapid automatized naming (RAN; Denckla and Rudel 1976)
Nonverbal Cognitive Abilities, Content Knowledge, Numeracy Skills:						
Nonverbal cognitive abilities	Categories Analogies (SON-R 2½ - 7)	Analogies (SON-R 2½ - 7)	Categories Analogies (SON-R 2½ - 7)	Analogies (SON-R 2½ - 7)	Categories Analogies (SON-R 2½ - 7)	Analogies (SON-R 2½ - 7)
Factual content knowledge	Faces & Places (K-ABC)		Faces & Places (K-ABC)		Faces & Places (K-ABC)	
Numeracy skills	Arithmetics (K-ABC)	Arithmetics (K-ABC)	Arithmetics (K-ABC)	Arithmetics (K-ABC)	Arithmetics (K-ABC)	Arithmetics (K-ABC)

(continued)

Table 1 (continued)

	1. MP autumn 2005	2. MP spring 2006	3. MP autumn 2006	4. MP spring 2007	5. MP autumn 2007	6. MP spring 2008
	Mean age 3;9 years	Mean age 4;0 years	Mean age 4;8 years	Mean age 5;0 years	Mean age 5;7 years	Mean age 6;1 years
Precursors of Reading:						
Phonological awareness	–	–	Rhyming (BISC)[1]			
Letter knowledge			Letter naming[1]	Letter naming[1]		Letter naming[1]
Metacognition, Theory of Mind, Mental Vocabulary, Verbal Self-control:						
Metacognition, declarative[4,5,6]	–	Knowledge about learning and memory[3]	Knowledge about learning and memory[3]	Knowledge about learning and memory[3]	Knowledge about learning and memory[3]	
Theory of mind[4,6]	–	False belief tasks[2,3] Knowledge-access task[2,3]	False belief tasks[2,3] Knowledge-access task[2,3]	False belief tasks[2,3] Knowledge-access task[2,3]	False belief tasks[,3] (incl. second-order tasks)	
Mental vocabulary[4,7] (in-depth comprehension)	–		based on Astington and Pelletier (1997)[3]	based on Astington and Pelletier (1997)[3]	based on Astington and Pelletier (1997)[3]	

(continued)

Table 1 (continued)

	1. MP autumn 2005	2. MP spring 2006	3. MP autumn 2006	4. MP spring 2007	5. MP autumn 2007	6. MP spring 2008
	Mean age 3;9 years	Mean age 4;0 years	Mean age 4;8 years	Mean age 5;0 years	Mean age 5;7 years	Mean age 6;1 years
Procedural Meta-cognition[5,7]			Memory task[3] (allocation of study time, confi-dence judgments, evaluation of difficulty)	Memory task[3] (allocation of study time, confi-dence judgments, evaluation of difficulty)	Memory task[3] (allocation of study time, confi-dence judgment, evaluation of difficulty)	
Verbal Self-control[5,7]			Puzzle, magnetic game[3]	Puzzle, magnetic game[3]	Puzzle, magnetic game[3]	

Notes: MP = Measurement Point. SETK 3–5, TROG-D, K-ABC, SON-R 2½ - 7, BISC: standardized tests with norms (see test index in the appendix); PPVT- unpublished German research version;
[1] only older children from the 44 preschools (139 children);
[2] only younger children from the 44 preschools (128 children);
[3] procedures used in the context of affiliated dissertations (cf. Dubowy 2010; Ebert 2011);
[4] see Ebert 2011, 2015 for more detailed task description and development;
[5] see Dubowy 2010 for more detailed task description and development;
[6] 44 preschools, 267 children;
[7] 11 preschools, 68 children (additionally tested in the context of dissertation projects).

Table 2 Assessments of facets of child development in the (meta)cognitive and language area in primary school

	School Year 2008/2009 End of 1st grade	School Year 2009/2010 End of 2nd grade	School Year 2010/2011 End of 3rd grade	School Year 2011/2012 End of 4th grade
Language:				
Vocabulary, receptive	*PPVT-R (research version)* KFT (Subtest 1)	*PPVT-R (research version)* KFT (Subtest 1)	*PPVT-R (research version)* KFT (Subtest 1)	*PPVT-R (research version)*
Grammar, receptive	TROG-D – adapted for group setting	TROG-D – adapted for group setting	TROG-D – adapted for group setting	
Listening comprehension (text-related; academic language demands)	Self-constructed (version V1)	Self-constructed (version V1)	Self-constructed (version V2)	Self-constructed (version V2)
Reading:				
Reading comprehension	Text comprehension (ELFE 1–6)	Text comprehension (ELFE 1–6)	Text comprehension (ELFE 1–6)	Text comprehension (NEPS-Test)[2]
Reading Speed		*SLS 1–6*	*SLS 1–6*	*SLS 1–6*
Working Memory, Speed of Information Processing:				
Memory span (verbal short-term memory)			*Digit span (K-ABC)*	*Digit span (K-ABC)*
Speed of information processing	*Rapid automatized naming (RAN*; Denckla & Rudel, 1976*)*	*Rapid automatized naming (RAN)*		
Nonverbal Cognitive Abilities (Reasoning), Mathematical Skills, Metacognition:				
Nonverbal cognitive abilities	CFT 1 (Subtests 3–5)	CFT 1 (Subtests 3–5)	CFT 20-R (Subtest Matrices)	CFT 20-R (Subtest Matrices)
Mathematical skills	*Arithmetics (K-ABC)* HRT 1–4 (Add, Sub, Supplement)	*Arithmetics (K-ABC)* HRT 1–4 (Add, Sub, Supplement)	*Arithmetics (K-ABC)* HRT 1–4 (Add, Sub, Supplement)	*Arithmetics (K-ABC)* HRT 1–4 (Add, Sub, Supplement)

(continued)

Table 2 (continued)

	School Year 2008/2009	School Year 2009/2010	School Year 2010/2011	School Year 2011/2012
	End of 1st grade	End of 2nd grade	End of 3rd grade	End of 4th grade
Metacognition, declarative[1]	Self-constructed (version V1)	Self-constructed (version V1)	Self-constructed (version V2)	Self-constructed (version V2)
Mental vocabulary[3]	Self-constructed according to Astington and Pelletier (1997)	Self-constructed according to Astington and Pelletier (1997)	Self-constructed based on Astington and Olson (1990)	Self-constructed based on Astington and Olson (1990)

Notes: *in italics:* assessments in individual settings at home only for children of the original sample; all other procedures: assessments in the classroom context (original BiKS sample and classmates); for children of the original BiKS sample who could not be tested in the classroom context, the listening comprehension, mental vocabulary, and metacognition were additionally assessed at home. PPVT, KFT, TROG-D (shortened), ELFE1-6, SLS1-6, CFT1, HRT, K-ABC standardized tests with norms (see appendix).

[1] see Haberkorn et al. 2014 for a detailed description of the tasks.

[2] see Weinert et al. 2019 for an overview.

[3] see Ebert 2020a for a detailed description of the tasks

present an overview of the direct measurements of children's abilities, skills, and competencies in the (meta)cognitive and language area conducted in the BiKS-3-18 study during preschool years (Measurement points (MP) 1 through 6), primary school years (MP 7 through 10), and after primary school (MP 11 through 13). Assessments included both domain-general and domain-specific indicators of child development and systematically differentiated verbal and nonverbal measures as well as measures that have been suggested to be more prone to environmental influences (i.e., that highly depend on education, e.g., specific content knowledge and specific education-dependent skills such as arithmetic skills) and those that are thought to be less influenced by environmental stimulations (e.g., indicators of nonverbal reasoning and working memory). Further, assessments covered both tests of important specific skills such as specific numeracy or language skills as well as broader measures of children's functional competencies such as measures on mathematical and reading literacy (Weinert and Artelt 2019, for a discussion of this distinction).

In addition, and particularly in affiliated PhD-projects (see Sect. 2.2), special emphasis was placed on the development of metacognition and a theory of mind

Table 3 Direct and report measures of domain-specific competencies and cross-domain abilities in the BiKS-3–18 study beyond primary school

	School Year 2014/2015 7th grade	School Year 2015/2016 8th grade	Last measurement point in 2020
Language (target, parent[2])	Receptive vocabulary: PPVT-R (research version)	Listening comprehension (DELKO, Marx and Stanat 2009)	
Reading Literacy		NEPS-Test on text comprehension[1]	
Mathematical competence	NEPS-Test[1]		
Metacognition, procedural, declarative	NEPS-Test[1]	NEPS-Test[1]	
Theory of mind	Strange Stories (Happé 1994; German adaptation Rakoczy et al. 2012)	Sarcasm (O'Reilly et al. 2014)	
Working memory: phonological loop, central executive	digit span forward digit span backward		
Verbal fluency (target, parent[2])	Word fluency test (RWT; fast generation of animals)	Word fluency test (RWT; fast generation of m-words)	
Cognitive flexibility (target, parent[2])	Word fluency test with task shifting (RWT; sports, fruit)	Word fluency test with task shifting (RWT; fast generation of g-/r-words)	
Knowledge test (target, parent)			Knowledge test (developed by U. Schroeders; Steger et al. 2019)

(continued)

Table 3 (continued)

	School Year 2014/2015 7th grade	School Year 2015/2016 8th grade	Last measurement point in 2020
Aspects of Development Assessed via Questionnaires and Interviews			
Social behavior (SDQ: target and parent judgement)	Hyperactivity/Inattention; Interaction with peers; Behavioral problems; Prosocial behavior; Emotional problems (all SDQ 11–16; Goodman 2005) Empathy (Früh and Wünsch 2009)	Aggressiveness (Little et al. 2003) Hostile attribution (Zdravkovic 2012)	Hyperactivity/Inattention; Interaction with peers; Behavioral problems; Prosocial behavior; Emotional problems (all SDQ 18+; Goodman 2005) Empathy (Früh and Wünsch 2009) Aggressiveness (Little et al. 2003)
Affective-motivational attitude	Joy of learning (BiKS-3–10; FEESS 3–4; Rauer and Schuck 2003)	Joy of school (FEESS 3–4; Rauer and Schuck 2003) Joy of learning (BIJU) Learning effort (FEESS 3–4; Rauer and Schuck 2003) School Attitude (BiKS-3–10)	School Attitudes (PISA 2009)
Life coping / Life satisfaction	Academic self-concept (BiKS-8–18) Well-being (KIDSCREEN) Satisfaction (NEPS) School grades, School career	Academic self-concept (BiKS-8–18) Well-being (KIDSCREEN) Satisfaction (NEPS) Self-esteem (NEPS) Delinquent behavior (Lösel and Bliesener 2003) School grades, School career	Academic self-concept (BiKS-8–18) Well-being (KIDSCREEN) Satisfaction (NEPS) Delinquent behavior (Lösel and Bliesener 2003) School grades, School career Health condition (KiGGS)

(continued)

Table 3 (continued)

	School Year 2014/2015 7th grade	School Year 2015/2016 8th grade	Last measurement point in 2020
Learning Environment	Parenting style (Wild 1999) Stimulation (Caldwell and Bradley 2003) Leisure activities (BiKS-3–10) Family climate	Leisure activities (SOEP) Quality of homework support (Dumont et al. 2014) Class climate	Parenting style (Wild 1999) Leisure activities (BiKS-3–10) Emotional support by parents (PISA 2015)

Notes: partly subscales; RWT: standardized test with norms (see appendix). Instruments are partially adopted from other studies (NEPS, SOEP, BIJU, KIDSCREEN, KIGGS, PISA) or developed by other groups (see references).

[1] see Weinert et al. 2019.

[2] Parent's indicator for vocabulary, fluency, flexibility were only assessed at one measurement point (see text)

(ToM), i.e., the developing understanding of one's own and others' cognition and the development of self-regulation. Moreover, in-depth analyses of characteristics of adult-child interactions extending the measurements of the educational BiKS Project 2 (Rossbach et al. this volume) were conducted.

Family background indicators (e.g., parental education, occupation, and family income; language background and language use in the family) and measures of children's social-emotional development were assessed via questionnaires and computer-assisted interviews with parents as well as by preschool and school teachers' questionnaires in cooperation with the other BiKS projects. Concerning social-emotional development, BiKS Project 3 focussed in particular on aggressive behavior, emotional self-regulation, peer relations/cooperative behavior, shyness, and attention/concentration which were coherently assessed across waves using a multi-informant approach.

2.2 Longitudinal Assessment of Child Development Across Waves

Preschool period. To assess educationally relevant facets of (meta)cognitive and language development (which we will also refer to as "competence development" further on), a total of six measurement waves were carried out every six months during the preschool period. Data collection took place in the preschools, where the children were tested in playfully designed individual settings by extensively trained project staff (at 1 to 4 days per measurement point). At the first wave (Measurement point (MP) 1) in fall 2005, all participating children ($N = 547$) were tested on three test days. They were presented with various standardized, internationally compatible tests that focused on different facets of children's cognitive and language development. As Table 1 shows, we assessed, for example, indicators of receptive and productive language (vocabulary; grammar: morphology; sentence production and comprehension), working memory (digit span; pseudoword repetition; nonverbal short-term memory),[3] speed of information processing (rapid automatized naming),[4] basic nonverbal cognitive abilities (reasoning; categorization), as well as indicators of children's numeracy skills and

[3] See Knöferle (2014) for a detailed description of the tasks (i.e., tasks/items that were not taken from standardized tests).

[4] See Ebert and Weinert (2013) for a detailed description of this task.

their factual content knowledge. Six months later (spring 2006, MP 2) about half of the children ($n = 267$) were again examined in central areas of development (language, working memory, basic nonverbal abilities, factual content knowledge, metacognition) with a smaller number of tests on one test day. On a second test day, these children were presented with additional measures. For instance, some of them received tasks on their theory of mind (see Ebert 2011, 2015 for more information), others on story comprehension (see Ebert and Weinert 2013). In fall 2006 and 2007 (MP 3 and 5), children's (meta)cognitive and language development were again assessed in the entire sample on two test days each, with the sub-sample of 267 children receiving supplementary tests on a third test day. The latter group was also tested again in spring 2007 (MP 4) in key areas of development. In spring 2008, i.e., at the last assessment wave before school enrollment (MP 6), (school-relevant) cognitive and language tests were again presented to all children. Since children who had started school early were no longer in preschool at the last two assessment waves, the testing of these children took place at their homes with a reduced test battery due to time constraints.

Additional in-depth assessments. In addition, a small, but systematically selected sub-sample of 68 mainly monolingual children representing a wide range of SES and individual differences was tested in depth at measurement points 3 to 5 within affiliated PhD-projects (Dubowy 2010; Ebert 2011). These assessments focused on the acquisition of self-regulation (procedural metacognition, e.g., allocation of study time, evaluation of task difficulty; verbal self-regulation via private speech assessed during videotaped individual playful task situations: see Dubowy 2010) as well as on the acquisition of metacognitive knowledge about memory and learning (i.e., declarative metamemory; see Dubowy 2010; Ebert 2011), the development of a theory of mind, i.e., the developing understanding of one's own and others' cognition and particularly of the significance of mental states as guiding human behavior, and the understanding of mental terms (Ebert 2011). Most of these assessments took place on an additional day in the preschools (individual setting). In this sample, also three semi-standardized dyadic interaction situations between the main caregiver and the child were realized in the home context and recorded on video (joint picture-book reading, memory game, construction game; see Ebert 2011).

During primary school years, direct measures of the children's (meta)cognitive and language development and other important school-relevant and school-related competencies were assessed at four measurement points mainly in the class context (group setting). The original BiKS sample was expanded to include their classmates (see Homuth et al. this volume). In addition to the assessments in the classroom setting, the children of the original BiKS sample were additionally tested in the home context with selected instruments that had already been used in preschool and required an individual test setting. Children of the original BiKS sample who could not be examined in the school context, e.g., because the school refused to participate, were tested individually at home in central developmental areas. Assessments addressed the following areas of development: language (listening comprehension: in particular, receptive vocabulary; receptive grammar: sentence comprehension; listening comprehension of texts featuring “academic language” characteristics of the language of schooling[5]); reading (text comprehension; reading speed); mathematics; metacognitive knowledge about memory and learning (also called ‘declarative metacognition’; note that declarative metacognition includes ‘metamemory’, i.e., the knowledge about memory); basic non-verbal abilities; information processing speed; verbal short-term memory (see Table 2).

In addition, within BiKS Project 3, at school age, several school lessons (mathematics, German, social studies and general sciences) were recorded on audio media (four measurement points: end of first grade, beginning and end of second grade, beginning of third grade; 56 classes, three lessons each) to analyze the effects of teachers’ language on children’s (meta)cognitive and language development beyond preschool on the one hand, and on their school performance on the other hand.

Beyond primary school, three further assessment waves took place, the first two in individual settings at the children’s homes and the last measurement wave was conducted in 2020 mainly as an online survey. When children were in Grade 7 and about 12 to 13 years of age, as well as one year later (see Table 3), the children were again presented with language tests (receptive vocabulary, listening comprehension of texts[6]), with tests on reading literacy and mathematical competence (tests developed and used in the National Educational Panel Study (NEPS); see Autorenteam Kompetenzsäule 2020; Weinert et al. 2019 for descriptions). Further assessments covered indicators of children’s theory of mind (measured via short stories: strange stories, sarcasm; see Ebert 2020b for a short description of these tasks), of working memory (digit span forward as an indicator of the capacity of phonological short-term memory (and the phonological loop of working

[5] See Kotzerke et al. (2013) for a brief description of this test developed by the BiKS Project 3.

[6] See Ebert (2020a, b) for a description of the task adopted from DELKO (Marx and Stanat 2009).

memory, respectively); digit span backward as an indicator of the central executive of working memory), and procedural metacognition (NEPS-indicator on metacognitive judgements of performance). Besides standardized tests and tasks, a focus was on social behavior, motivational attitudes, life satisfaction, well-being, school career and success, as well as on leisure activities as outcome measures; furthermore, indicators of parenting behavior and family climate were assessed (e.g., parenting style, stimulation, family climate). As those measures were a special focus of the respective assessment waves, indicators are also listed in Table 3. This latter focus was also addressed in the online survey at the last measurement point when the participants were about 18 years old. In addition, during these last three waves, some short indicators of parents' knowledge (last wave in 2020), their verbal fluency and cognitive flexibility (in 2014/2015) as well as their vocabulary skills (2015/2016) were assessed once with parallel tests given to the target persons.

3 Selected Empirical Findings: Domain-Specific Trajectories, Interrelations Between Domains, and Environmental Conditions

In the following, we report selected findings on children's development during preschool years with special attention given to child language. We thereby focus on both environmental factors and child characteristics that are relevant to children's language and (meta)cognitive development and present results on the predictive impact of early developments, particularly in the language domain, on later outcomes. In particular, we (1) present results on early emerging domain-specific performance differences between children, their stability across time, and their relation to children's socioeconomic family background (SES). (2) With a focus on language development, we address the impact of child characteristics and the dynamics of early child development by presenting findings (a) on changing developmental relations between working memory and language acquisition and (b) on the interrelations between early child language and children's social-cognitive, metacognitive, and social-emotional development. (3) Finally, we report findings on the importance of early individual differences in child development, particularly in child language, and SES-related disparities for later school-related language competencies and school performance.

3.1 Early Emergence and Stabilization of Domain-Specific Individual Differences and Their Relation to Family Background

Of course, children differ in their individual resources and potentials from the very beginning of their lives. From early on, children's individual abilities and prerequisites interact with their learning environments. In the following we summarize findings of the BiKS-3-18 study documenting that domain-general cognitive abilities and specific knowledge-based skills can be distinguished already at the age of 3 years. In addition, we report findings that show that individual differences in those domain-specific developments that are particularly prone to environmental conditions, stabilize early and are significantly associated with the children's family background.

Early Stabilization of Domain-Specific Individual Differences

One important result of the BiKS-3-18 study is that individual differences in education- and knowledge-dependent skills as well as SES-related disparities in these developments emerge and stabilize early in preschool age and thus long before school entry (Weinert et al. 2010).

As Weinert et al. (2010) document, already at the age of 3 years shortly after having entered preschool, results of the BiKS-3-18 study demonstrate a differentiated achievement profile: Children who are more or less advanced in one area of development are not necessarily accelerated or restricted in other developmental areas. Exploratory factor analysis and multidimensional scaling of the broadly assessed early indicators of children's domain-general cognitive abilities (verbal working memory, nonverbal cognitive abilities) and their domain-specific (language and numeracy) skills showed the theoretically predicted differentiation between achievement domains already at the age of 3 years. As expected, a distinction can be made between a language factor, a working memory factor, and a reasoning factor. As suggested by models of skill and knowledge acquisition, indicators of knowledge-based numeracy skills loaded on all three factors, while children's achievement on a factual knowledge test loaded particularly on the language and working memory factor (Weinert et al. 2010, p. 38).

Although all children showed substantial developmental progress over the next years, the observed individual differences between children remained rather stable across the preschool period (Weinert et al. 2010, p. 40; see Table 4).

In particular, the early emerging interindividual differences in language and knowledge-based skills (numeracy skills; factual knowledge) proved to be very stable between ages 3 and 5 even when controlling for age differences (see Table 4).

Table 4 Early achievement differences at the age of 3 years predicting differences at the age of 5 years (stabilities of individual differences over a two-year-period) (adapted from Weinert et al. 2010, p. 40)

	r (age controlled)	*n*
Language skills	0.74**	442
Knowledge-based skills	0.86**	456
Verbal working memory	0.49**	434
Nonverbal abilities	0.47**	441

Note: ** $p<0.01$. *n*: number of subjects. *r:* correlation

In agreement with other longitudinal studies, measures of verbal memory and non-verbal cognitive abilities showed comparatively lower stability of individual differences (Weinert et al. 2010; see also, e.g., Niklas et al. 2010; Schneider et al. 1998).

Thus, especially children's education-dependent domain-specific developments (early language, numeracy skills, factual content knowledge) showed an early stabilization of individual differences. As we report in more detail below, these differences have a major impact on further development. These developments may be characterized by a cumulative acquisition process under relatively constant environmental conditions. This may explain the early stabilizations of the interindividual differences. However, it must be taken into account that the assessment of working memory and nonverbal abilities could be influenced to a greater extent by situation-dependent attentional processes in young children, which may restrict reliability and thus stability.

Over and above the high stability of individual differences in the education-dependent domain-specific developments in language, numeracy skills, and factual knowledge, additional analyses show that the performance variance in these skills does not decrease over the preschool period, but rather increases over time. Concerning the development of receptive vocabulary, for example, a substantial increase in variance by about 36% showed up (Weinert et al. 2010, p. 41), which is, at least partially, due to increasing differences (Matthew effect) between children with a German and a non-German family language background (Ebert et al. 2013; Weinert and Ebert 2017). Yet, despite high stabilities of individual differences in developmental trajectories, a large amount of variance (e.g., more than 40% in the language domain) remains unexplained by preceding performance differences hinting to internal and external influencing factors that may explain changes in individual differences and developmental trajectories (see below and Lehrl et al. this volume).

Early Emergence of Disparities in Domain-Specific Development Related to Family Background

It is one of the alarming results of the BiKS-3-18 study that significant disparities in education-related areas of child development (i.e., language, numeracy skills, and factual content knowledge) are already present in early preschool age, both as a function of the family's language background (Dubowy et al. 2008; Ebert et al. 2013) and in connection with parents' SES as indicated by parental education, occupation, and family income (Ebert et al. 2020; Weinert et al. 2010, 2012; Weinert and Ebert 2013). At the same time, the children's performance in nonverbal reasoning tasks was less associated with children's family background (Dubowy et al. 2008; Kurz et al. 2008; Weinert et al. 2010).

In particular, BiKS findings show that—despite substantial heterogeneity within social groups—SES-related disparities were particularly pronounced in the language area (Weinert et al. 2010, p. 39). This is troubling because—as already mentioned—differences in early language development prove to be relatively stable over time and are considered and empirically demonstrated to be highly important for other areas of development including knowledge acquisition, social-cognitive (theory of mind), metacognitive, and social-emotional development as well as school performance (see Sect. 3.2, 3.3).

Considering different models of language acquisition, it is particularly interesting that SES-related disparities are not only evident in children's vocabulary, but also in their early grammar at the age of only three years (Weinert and Ebert 2013). In fact, SES-related disparities in early vocabulary and grammar were even comparable and, depending on the family background indicator, explained between 6 and 12% of the observed variance between (monolingual German-speaking) children. This did not change significantly over preschool years although all children included in the study attended preschool (Weinert and Ebert 2013). Note that these analyses considered monolingual children only to not confound disparities due to families' SES with multilingual development.

Thus, contrary to nativistic assumptions (in the tradition of Baker 2001; Chomsky 1981; Pinker 1994; see Weinert and Grimm 2018), not only vocabulary but also early grammar acquisition seems to be affected by family background and environmental language stimulation. More recent results using data of the German National Educational Panel Study further confirm this finding for even younger children (Attig and Weinert 2020). Regarding children from families with a background of migration (or more precisely: with a non-German language background), performance gaps in vocabulary further increased compared to children without a background of migration over the course of preschool (for additional results on children with a background of migration see Ebert and Weinert this volume; Dubowy et al. 2008; Ebert et al. 2013).

At school, SES-related disparities prove to be particularly pronounced when it comes to more sophisticated "academic language" requirements (Kotzerke et al. 2013, 2014; see also Berendes et al. 2013). With regard to rather basic language skills necessary in everyday language use, social and migration-related differences decrease in the course of primary school, as children from socially disadvantaged families and non-German-speaking homes increasingly master tasks, e.g., on basic sentence comprehension in German (Ebert and Weinert this volume; Kotzerke et al. 2014). However, concerning the comprehension of more complex sentences used in the language of schooling, some children still show significant limitations even in third grade (Ebert and Weinert this volume; Kotzerke et al. 2014; see also Berendes et al. 2013). These findings converge with other empirical results documenting increasing SES-related disparities in academic language proficiencies in the language of schooling as well as an increasing gap between children with and without a background of migration over primary school years (e.g., Volodina et al. 2020).

3.2 Developmental Relations Between Domains of Development

Although research shows that child development and the acquisition of competencies are domain-specific endeavors with domain-specific trajectories, there are also important and dynamic developmental relations between domains (e.g., Weinert 2020, 2022, for overviews). Thereby the specific relations and direction of influence between domains may change dynamically across development (Weinert and Ebert 2017). The BiKS findings that are reported in the following underline this assumption and highlight the importance of differentiating between the prediction of *outcomes* and the prediction of *developmental progress*. We focus here on relationships between language development and other areas of development to illustrate that development in the important and educationally highly relevant domain of language is not only stable, but also dynamic and interrelated with various other areas of development.

Working Memory as an Important Predictor of Early Vocabulary Acquisition: Group-Specific Differences and Changing Relations

It is well documented that interindividual differences in working memory capacity and children's vocabulary *status* are substantially associated both simultaneously and across ages (Ebert et al. 2013; Knöferle 2014; for overviews Gathercole and Baddeley 1993; Weinert 2010, 2020). Yet, for vocabulary *growth*, the BiKS findings show that individual differences in measures of working memory capacity prove to be predictive especially in the early phases of vocabulary acquisition (Ebert et al. 2013; Weinert et al. 2012). In particular, using growth curve modeling, an effect of working memory capacity on vocabulary *growth* (slope) between age three and five years could only be demonstrated in children with a non-German language background and thus with a comparatively limited vocabulary in the majority language German (Ebert et al. 2013) as well as in monolingual German-speaking children with comparatively limited language skills at the beginning of the study (Weinert et al. 2012) but not for monolingual children with more advanced vocabulary skills. At the same time, differences in working memory were substantially associated with children's vocabulary at the first measurement point in all groups (intercept).

Further analyses show, that despite simultaneous and time-delayed associations between various measures of verbal working memory (digit span, pseudoword repetition; Knöferle 2014, p. 166), only pseudoword repetition predicted the *changes* in individual differences in vocabulary within cross-lagged panel analyses (Knöferle 2014, p. 168, 206). Thus, the BiKS findings substantiate and extend the assumption, that particularly the repetition of pseudowords, i.e., the immediate reproduction of prosodically structured non-words, is predictive for vocabulary progress (Knöferle 2014; see Gathercole 1995 for related findings). Moreover, the relation between working memory and vocabulary may change across development (e.g., Gathercole and Baddeley 1993). In the early phases of vocabulary development, working memory is particularly predictive as BiKS data show. Later on, the acquired vocabulary seems to become "a major pacemaker in the developmental relationship" (Gathercole et al. 1992, p. 887; see Weinert 2010, for an overview).

Developmental Relations Between Early Language and the Development of Theory of Mind and Metamemory Knowledge

Acquiring a theory of mind (ToM) is thought to be highly relevant to both social-emotional as well as cognitive development (e.g., Ebert 2011, 2015; Lockl et al. 2017). "Theory of mind" means the developing ability of children to attribute mental states to themselves and others and to understand that people act according to their mental states (such as beliefs, wishes, knowledge) which may differ between persons and may also deviate from reality. Metamemory knowledge (or declarative metamemory; both terms are used interchangeable in the following) also addresses children's developing understanding of one's own and others' minds but with a special focus on memory (e.g., understanding that one may forget things; that it is harder to remember more items compared to fewer items; that additional study time may be helpful; Ebert 2011, 2015; Haberkorn et al. 2014; Kreutzer et al. 1975; Lockl and Schneider 2006, 2007; Lockl et al. 2016; Wellman 1977).

As language is an important means for communication as well as for coding mental states and complex propositions which are often used when talking about mental states, language has been suggested to impact on children's ToM development. The significant role of language for acquiring ToM is empirically supported by experimental (e.g., Lohman and Tomasello 2003), quasi-experimental (e.g., Nilsson and de Lopez 2016; Peterson and Siegal 2000), and longitudinal studies (e.g., Weinert and Ebert 2017, for a brief overview). Following other findings (see Milligan et al. 2007, for a meta-analysis), the BiKS-3-18 study shows that children's early language skills are highly predictive for later ToM performance (Ebert 2011, 2015, 2020a, b). Over and above predicting later ToM *performance*, analyses of the BiKS-3-18 data (Ebert 2011, 2015) show that early language skills also predict ToM *development* over the preschool years which in turn predicts the development of metamemory knowledge. In particular, children's early language skills at age 3;2 were closely related to both their ToM and their metamemory knowledge at age 3;8 (both intercept), and thus predictive of both performances half a year later. In addition, early language also predicted ToM *development* over the next years (slope) and, though less pronounced, progress in metamemory knowledge (Ebert 2015). Further—as already mentioned—early ToM understanding remained an important pacemaker for the development of metamemory knowledge (i.e., declarative memtamemory), at least in preschool age (Ebert 2011, 2015), but not in school age (Ebert 2020a).

Looking at an extended developmental period up to age 13, the BiKS-3-18 study demonstrates that early language skills in preschool age predict changes in ToM also between age 5;6 years and 12;8 years (Ebert 2020b). Here, it was particularly sentence comprehension, rather than vocabulary, that proved predictive of change in ToM over time. However, investigating this longer developmental period there are also effects of early ToM on children's language competencies, particularly on changes in vocabulary (Ebert 2020b) and listening comprehension (Ebert 2020a).

Findings of the BiKS-3-18 study according to Ebert's (2011) analyses also demonstrate that the relations between specific language skills and metamemory knowledge are subject to dynamic changes over preschool age (see Fig. 1).

Thus, at the age of about 4 ½ years, basic knowledge about memory (declarative metamemory) predicted the acquisition of a differentiated in-depth understanding of mental terms (i.e., understanding the exact meanings of mental verbs, such as *know*, *remember*, *believe*, *forget*). Later on, this relation changed. Now it was the understanding of specific word meanings (mental verbs) that predicted

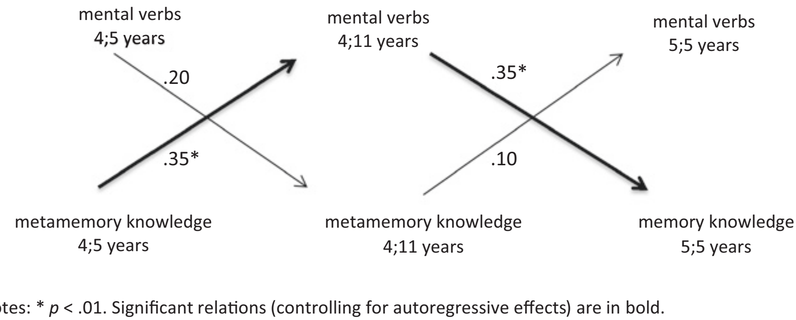


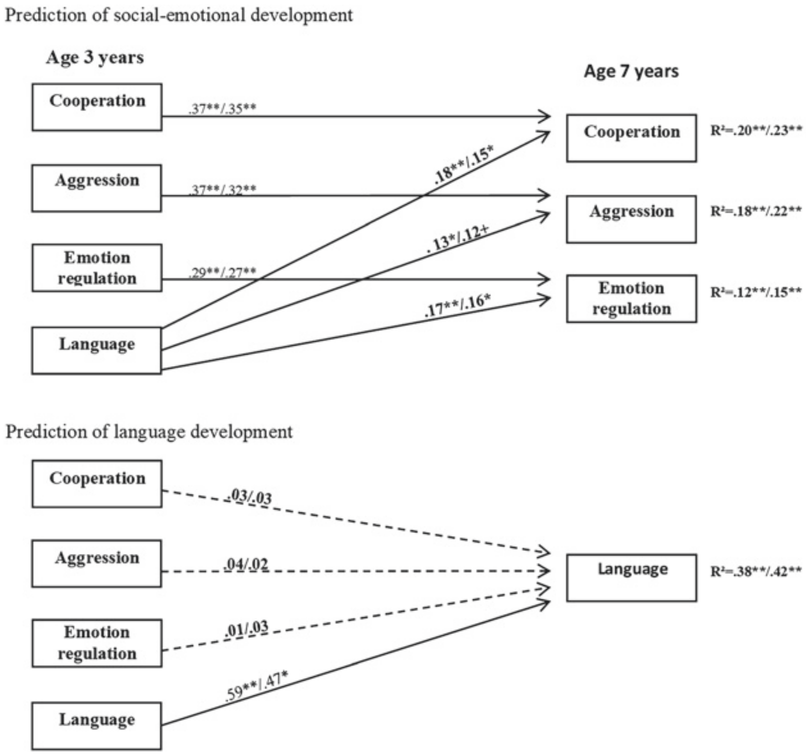
Fig. 1 Cross-lagged correlations (controlling for autoregressive effects) between comprehension of mental verbs (such as know, remember, believe, forget) and metamemory knowledge between 4 ½ and 5 ½ years of age (age in years and months; adapted from Ebert 2011, p. 335)

changes in metamemory knowledge as a cross-lagged panel analysis suggested (see Fig. 1). This implies that children are working on an understanding of the mental world, with a relatively general knowledge about mental processes such as memory (declarative metamemory) initially predicting the acquisition of specific word meanings. Once these are acquired, they contribute to the further acquisition of metamemory knowledge.

Note that the BiKS-3-18 study not only showed early roots and developments of declarative metamemory but also allowed to study early developing facets of procedural metacognition (e.g., verbal self-regulation, study time allocation, judgements on task difficulty). As shown by Dubowy (2010), these facets were not closely related to each other. Yet, these developments have been suggested to be particularly important for later school learning.

The Predictive Impact of Early Language on Later Social-Emotional Outcomes

An important result of the BiKS-3-18 study is that children's early language development as measured by tests on vocabulary and grammar is not only related to their later cognitive and metacognitive skills and knowledge, but also to their social-emotional competencies. This is shown, for example, by cross-lagged panel analyses conducted by Rose et al. (2016; see Fig. 2). These analyses document, that differences in children's early language skills at age 3 predicted both children's social-emotional outcomes at the end of first grade (as judged by parents and teachers in a multi-informant perspective) as well as the *changes* of individual differences across a 4-year-period from early preschool into school (see



Note. Path coefficients (1st coefficient based on model without additional controls ($N = 551$; $\chi^2 = 28.15$ (df = 6); $p < .01$; CFI = .97; TLI = .88; RMSEA = .08; AIC = 6561.61) / 2nd coefficient based on model with additional controls ($N = 531$; $\chi^2 = 27.60$ (df = 6); $p < .01$; CFI = .97; TLI = .80; RMSEA = .08; AIC = 13166.40). + $p < .10$, * $p < .05$, ** $p < .01$

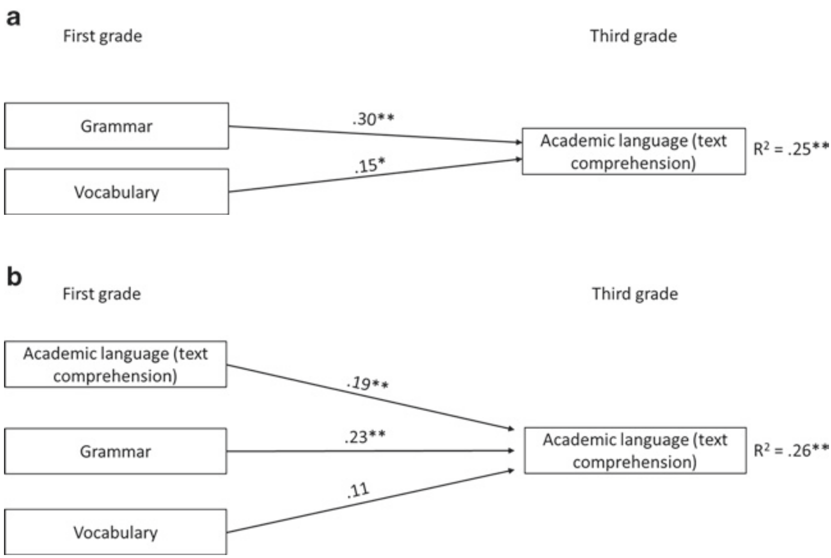
Fig. 2 Path-model on the relation between social-emotional and language development from age 3 to age 7 (adapted from Rose et al. 2016, p. 70)

Fig. 2; cross-lagged panel analysis statistically controlling for early differences in children's social-emotional skills and additionally for family's socioeconomic and language background, children's sex, and their nonverbal cognitive abilities at first measurement point). The relations proved to be unidirectional as early social-emotional skills did not significantly predict language development during that time period when early language skills were taken into account (Rose et al. 2016). Further analyses extended these relations to also hold from age three to eight years (Grade 2) and even over 10 years (Rose et al. 2022, 2018a, 2018b). Possible explanations why early language impacts on social-emotional development are multifold. On the one hand, language can support social-emotional self-regulation through self-directed private speech (e.g., Prizant and Wetherby 1990); on the other hand, verbal communication is important for relationships with peers and for coping with conflicts (e.g., via verbal conflict resolution). In addition, restricted language comprehension might contribute to developing a so-called hostile attribution bias, i.e., a tendency to attribute a hostile intent in case of conflicts or injuries in ambiguous situations (Rose et al. 2022) leading to reactive aggression (e.g., Dodge 1980). In support of this assumption, path models using BiKS-3-18 data showed that children's language skills at age 3 predicted aggressive behavior (self-ratings on facets of aggression) and hostile intention attributions over 10 years, even when controlling for important child and family characteristics and initial levels of aggressive behavior at age 3. Moreover, the hostile intention attributions mediated the predictive impact of early language on later aggressive behavior (Rose et al. 2022).

3.3 Individual and SES-Related Differences in School-Relevant Skills and Their Impact

The results reported so far show early emerging individual differences and SES-related disparities in children's domain-specific development which remain rather stable across preschool age or even increase during this time. Further, shortly before school entry (MP 6) BiKS-3-18 data document severe differences between children in school-relevant abilities and skills as well as SES- and migration-related disparities related to family background (Kotzerke et al. 2013; see also Ebert and Weinert this volume). In particular, in monolingual German-speaking families we found substantial differences in their children's numeracy skills, letter knowledge, and sentence comprehension depending on their mothers' education, though there were no differences in the children's basic nonverbal cognitive abilities (Kotzerke et al. 2013). Interestingly, when comparing children with and without a background of migration (language background) no differences showed up in the children's letter knowledge (under control of family's SES as indicated by the Highest International Socio-Economic Index of Occupational Status [HISEI]; Ganzeboom et al. 1992). Yet, children with a background of migration showed clear limitations with respect to their German language proficiency (sentence comprehension; group difference between children without and with a background of migration (both parents; only one parent): effect size = 0.12).

The latter was especially true for children whose both parents speak a mother tongue other than German (Kotzerke et al. 2013; see also Ebert and Weinert this volume). The differences in sentence comprehension explained substantial variance in later text-related listening comprehension in German (also when statistically controlling for children's nonverbal cognitive abilities and family's SES). As summarized in Fig. 3, analyses by Kotzerke et al. (2012) suggest that listening comprehension of texts that included features that have been suggested to be typical for the language of schooling (i.e., children's academic language proficiency) in Grade 3 is related to both children's earlier vocabulary and grammar skills at school entry. This result (i.e., the predictive relation of early language for later text-related listening comprehension) holds even up to the age of 13 (Ebert 2020a, b). While both vocabulary and grammar skills at primary school entry are predictive for later differences in academic language proficiency (text comprehension; Fig. 3a) and even across an extended time period (Ebert 2020b),



Note. Coefficients are standardized Beta-weights (additionally controlling for differences in basic nonverbal cognitive abilities (CFT-1, Cattell et al. 1997) and SES (ISEI: International Socio-Economic Index of Occupational Status, Ganzeboom et al. 1992) in first grade. * p < .05. ** p < .01. Analyses by Kotzerke et al. 2012.

Fig. 3 Results of regression analyses predicting later academic language proficiency (listening comprehension of texts characterized by academic language features)—with (3b) and without (3a) controlling for differences in Grade 1 children's grammatical skills (comprehension of sentences differing in grammatical structure) proved to be particularly predictive for the *development* of text comprehension over primary school years. As Fig. 3b shows, grammar is even predictive for later academic language proficiency when controlling for early performance differences in academic language in Grade 1, for nonverbal cognitive abilities (CFT1; Cattell et al. 1997) and family's SES (ISEI; Ganzeboom et al. 1992). Early vocabulary as well as nonverbal abilities both lose their significant predictive impact on later academic language (text comprehension) when controlling for earlier differences in academic text comprehension at school entry (see also Kotzerke et al. 2013).

Further, as predicted, listening comprehension of texts with features of academic language explained a substantial proportion of variance in children's school performance in second grade—even in monolingual German-speaking children. This was shown for children's school performance (school grades) in social studies and general sciences ($r = 0.52$) as well as in German ($r = 0.41$), and mathematics ($r = 0.36$) (Kotzerke et al. 2013; see Table 5). The substantial relation between language skills and school grades remained significant even when controlling for children's age and nonverbal cognitive abilities (see Table 5). The importance of early language skills for school performance is also substantiated by their predictive relation to later reading comprehension (Ebert 2020a, b; Ebert and Weinert 2013). Further analyses show, that the children's (sophisticated) academic language skills explained the comparatively largest share of the variance in achievement in social studies and general sciences—compared to children's age, nonverbal cognitive abilities, and family's SES—and mediated the SES-related disparities: Social background characteristics lost their effect on children's school performance when children's language skills were included into the model (Weinert et al., in prep.; see also Kotzerke et al. 2013). Similar findings, although not as pronounced, are also found for the subjects German and mathematics. Thus, language seems to be an important mediator of the observed SES-related disparities in school performance even in monolingual children.

3.4 Conclusions and Prospects

The BiKS-3-18 study allows to analyse the early emerging individual differences and SES-related disparities in school-relevant areas of child development, their dynamic interrelations and important internal and external influencing factors. With a special focus on the important domain of language, this chapter summarized results on the stability, dynamic interrelations, and the impact of early indi-

Table 5 Relation between (academic) language proficiency (test on listening comprehension) and school performance (teacher judgement) in second grade (monolingual children) (adapted from Kotzerke et al. 2013, p. 127)

Academic language skills	German	Mathematics	SSS
Bivariate correlation ($n = 208$)	−0.41**	−0.36**	−0.52**
Controlled for nonverbal abilities ($n = 205$)	−0.33**	−0.29**	−0.46**
Controlled for age & nonverb. abilities ($n = 199$)	−0.31**	−0.27**	−0.45**

*Note: ** $p < 0.01$ (two-tailed), negative relations are due to school grades ranging from 1 (highest grade) to 6 (lowest grade); nonverbal cognitive abilities: CFT 1 (Cattell* et al. *1997). SSS: social studies & general sciences*

vidual and SES-related disparities. The reported findings show pronounced and stable individual differences and SES-related gaps in early education-dependent and educationally relevant domain-specific skills, especially in early language skills. These prove important for other school-relevant competencies and developments, e.g., metamemory development, the development of a theory of mind, and facets of social-emotional development such as emotional self-regulation, peer relations/cooperative behavior, and aggression. Early language skills are also predictive of children's later more sophisticated academic language proficiency, which is highly relevant to learning across school subjects (including mathematics, see e.g., Table 5; Ebert 2020a; Kotzerke et al. 2013; see also Heppt et al. 2020). Children with advanced language skills at an early age perform better at school and are rated as more socially competent and socially acceptable by their parents and teachers.

Because early child language is particularly important for further development and associated with a variety of developmental domains, the question arises as to which factors in the home-learning environment as well as in institutional settings might contribute to successful language development (see Lehrl et al. this volume). The observation of early emerging and rather stable SES-related disparities in early language development as well as results showing a Matthew effect, i.e., an increasing gap in more sophisticated academic language skills in school age (e.g., Volodina et al. 2020) with a significant impact on school performance (Heppt et al. 2020; Schuth et al. 2017; see also Sect. 3.3) points to important influencing factors in the home-learning and early institutional environments as assumed in bioecological models of development (e.g., Bronfenbrenner and Morris 2006). The BiKS-3-18 study provides important insights into the dynamics of developmental trajectories as well as into the complex interplay between the home-learning and the institutional learning environments, which were especially recorded in the educational BiKS Project 2 (see Rossbach et al. this volume). In particular, as documented in Lehrl et al. (this volume), the BiKS-3-18 study supports the Specificity Principle (Bornstein 2017) by showing that both vocabulary and grammar acquisition are influenced by the learning environment from early on (see Sect. 3.1 this chapter), with different aspects of the learning environment promoting either of them (Ebert et al. 2020; Lehrl et al. 2012; Weinert and Ebert 2017; see Lehrl et al. this volume). Further, these different aspects of the learning environment are not highly associated (see also Attig and Weinert 2020; Ebert et al. 2020). Thus, families that show more effective stimulation of children's vocabulary development do not necessarily promote children's grammar or early reading (e.g., letter knowledge) to the same extent (Ebert et al. 2020; Lehrl et al. 2012). In addition, SES-related disparities in different language skills, such as vocabulary, grammar, early reading, are related to different language promoting factors as summarized in Lehrl et al. (this volume).

Overall, findings of the BiKS-3-18 study hint to a significant impact of early child development on later developments and educational success. Individual differences and SES-related disparities emerge early in life and relate to further developmental trajectories in other areas of development as shown in the present chapter for language development. Furthermore, individual differences are influenced by distal (e.g., SES as shown in the present chapter or language background of the family, see Ebert and Weinert this volume) and by differentiated proximal factors of the learning environments (see Lehrl et al. this volume for findings of the BiKS-3-18 study). The high impact of early child development on future development and school success has important practical implications: In particular, early child language and child development should be addressed by early promotion programmes targeted to families, children, and institutions to reduce the early emerging SES-related gaps and to foster all children in their development.

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CFT 1. Cattell, R. B., Weiß, R. H., & Osterland, J. (1997). *Grundintelligenztest Skala 1* (5th rev. ed.). Hogrefe.

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ELFE 1–6. Lenhardt, W., & Schneider, W. (2006). *Ein Leseverständnistest für 1. bis 6. Klassen.* Hogrefe.

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Development of Majority Language Skills in Children with Different Family Language Backgrounds: Results from the BiKS-3-18 Study

Susanne Ebert and Sabine Weinert

Abstract

Given that social disparities evolve early in development (cf. Weinert and Ebert this volume), the main aim of this chapter is to learn more about how disparities in (majority) language skills develop in preschool children when their parents have a nonnative German language background. For this purpose, we refer to key findings from the longitudinal study BiKS-3-18. These demonstrate that especially children with two nonnative German-speaking parents are disadvantaged in majority language development, particularly when the everyday language in the family is not German or when the family feels less integrated into German society. However, these two factors correlate only marginally, and both change over the preschool years. Moreover, our results suggest that the quality, and not the pure quantity, of German language interaction within the family promotes children's majority language development. Further, results show that internal factors such as verbal working memory are

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an important explanatory factor for children's language development in the majority language when children grow up with more than one language. Concerning external factors in the environment, the study can hardly demonstrate the effect of language and literacy support in preschool for children's majority language development. We discuss how the results of the BiKS-3-18 study can (and cannot) contribute to an understanding of the complex developmental process of majority language development in preschool children.

Keywords

Language development · Migration background · Language use at home · Perceived integration in society · Changes over time

Introduction

Although there is a huge heterogeneity, many children growing up in families with a history of migration experience more than one language in their everyday lives. These children often grow up not only with the majority language of the country in which they live, but also with a second or even third language: that of their family. Thus, these children acquire language skills not only in the majority language of society but also in the language(s) of their family's country of origin. Since these language(s) might be cultivated more or less strongly in the family, the question arises as to how such (external) environmental factors interrelate with the children's (internal) language development.

The importance of (external) proximal and more distal environmental conditions and how these interact with children's developing (internal) preconditions are highlighted in bioecological models of child development (Bronfenbrenner and Morris 2006). Indeed, (monolingual) language development is accompanied by numerous changes in, interactions with, and characteristics of the child's proximal and distal physical and social environment. Moreover, language development relates to further cognitive, social-cognitive, and social-emotional development and educational outcomes (see also Weinert and Ebert this volume, for results of the BiKS-3-18 study on this issue). Thus, when (monolingual) language development is impacted by external environmental conditions, differences in the multilingual environment will impact a fortiori on children's development of the majority language.

However, although numerous studies focusing on the educational disadvantages of children with a migration background explain these disadvantages in terms of reduced language skills in the majority language (e.g., Esser 2006; Hoff 2013; Prevoo et al. 2016), less is known about how these limited language skills develop, and about what (internal) factors in the child and what (external) factors in the environment impact on these developments (see, e.g., Hammer et al. 2014; Heckman et al. 2013). Moreover, there is little research on how various aspects that are supposed to be related to majority language development change themselves—for example, how the use of the majority language within the family changes over time. In addition, given that the development of domain-specific competencies and the emergence of social disparities start well before school entry (see Weinert and Ebert this volume), there is a need to investigate the development of the majority language well before children enter school. This is even more important because it has been suggested that early developments are highly relevant for later developments, educational pathways, and participation in society (e.g., Heckman 2008).

Against this background, the main aims of the present study are to learn more about (a) the development of the majority language in preschool children growing up in families with a non-majority native language background, (b) the development of their environmental conditions associated with language development, and (c) how these developments are interrelated. Specifically, we focus on how differences in children's language environment change, and we ask how these are associated with the development of disparities in (majority) language competencies. Therefore, we draw on Bronfenbrenner's bioecological approach (e.g., Bronfenbrenner and Morris 2006) and differentiate between internal factors (e.g., children's abilities and skills) and external factors (e.g., language stimulation in the family and educational institutions) that are important for the development of majority language and literacy skills under these—albeit interindividually often very different—conditions found for children with a family background of migration. This is highly relevant, because it can provide a first basis for effective language support in the majority language that is then so crucial for future educational careers and participation in society (e.g., Heckman 2008; Heckman et al. 2013).

In light of our aim to learn more about children's language development in the majority language, the longitudinal BiKS study provides important insights into relevant individual preconditions, developmental trajectories, and their relation to learning opportunities in different learning environments of children growing up with not only the language of the majority. Hence, we report key findings from the longitudinal study BiKS-3-18 ("Educational Processes, Competence

Development, and Formation of Educational Decisions in Preschool and School Age")[1] on the early development of majority language skills in children growing up in families with a minority language background due to a family history of migration. The focus will be on language development in preschool-age, a period when children are assumed to be particularly good language learners (see Weinert 2004a, for an overview). We focus on the acquisition of receptive majority language skills, particularly in the area of vocabulary and grammar (especially sentence comprehension). These receptive language skills were examined more closely in the BiKS-3-18 study and are considered to be school-relevant (e.g., for understanding teachers' instructions and explanations) and linked closely to literacy development—that is, to the acquisition of reading and writing (e.g., Dickinson et al. 2003; Ebert 2020; Ebert and Weinert 2013; Muter et al. 2004).

Restricted by the data of the BiKS-3-18 study, we can look at only a small part of the children's language development. Of course, children's receptive language skills in the majority language are only a small segment of children's language development in general, and there is much more in children's language development—to name just the development of productive language and the development of children's language competencies in their family's native language(s). However, competencies in the majority language are said to be especially important for successful social integration, and are regarded as central explanatory factors for disparities in educational careers associated with the family's native language or languages (e.g., Esser 2006; Hoff 2013; Stanat 2006).

Drawing on BiKS-3-18 data, we first look at the competencies of children at the beginning of their preschool years. In particular, we take a closer look at the (German) language skills of children who have at least one nonnative German-speaking parent, and compare these to the (German) language skills of children growing up in monolingual German families. Then, we take a closer look at the subgroup of children with two nonnative German-speaking parents: We present results showing how their (German) language competencies are related to the families' language use at home and their parents' perceived integration into German society. In addition, we report on changes in the everyday language used in the family (i.e., the customary use of language in the family), the perceived

[1] The Bamberg research unit BiKS conducted two comprehensive longitudinal studies funded by the German Research Foundation (Principal investigators: C. Artelt, H.-P. Blossfeld, G. Faust, H.-G. Rossbach, and S. Weinert). Here we report on findings based on the longitudinal study BiKS-3-18 that traced children's development from 3 to 10 years and, later on in subsequent projects, until 18 years (see the introductory chapter to BiKS by von Maurice et al. this volume).

integration into society, and the children's (German) language competencies over the preschool years up to primary school. Furthermore, we consider explanatory approaches addressing interindividual differences in the observed changes in the children's (German) language skills.

Before going to the main part of the study, we give a short overview of the BiKS-3-18 sample with a special focus on children's language background (see, for more general information, also Weinert and Ebert this volume; Homuth et al. this volume).

1 The BiKS-3-18 Sample

Overall, the interdisciplinary longitudinal study BiKS-3-18 focused particularly on family and institutional conditions and their effects on children's development. Within this framework, a large number of indicators of cognitive and language development were recorded longitudinally in an initial sample of 547 three-year-old children ($M = 3;8$ years; $SD = 5.0$ months). These children were sampled from 60 Bavarian and 37 Hessian preschools (see, for more detailed information, von Maurice 2007, and further chapters in this volume). A total of 428 children (78.2%) came from families in which both parents reported that their mother tongue was German: Here, we define these families and their children as native speakers. In 53 families (9.7%) of the BiKS-3-18 sample, one parent claimed to possess another mother tongue than German. Here, we define these families as one-parent nonnative German-speaking. In 66 families (12.1%), both parents reported possessing another mother tongue than German. Here, we define them as families in which both parents were nonnative German-speaking. In a single-parent household, we focused on the mother tongue of this parent alone. In other words, if the single parent reported having another mother tongue than German, we grouped this child to the nonnative German-speaking families, and if the single parent reported having German as her or his mother tongue, the child was grouped to the native German-speaking families. Among families in which both parents were nonnative speakers of German, most parents were from the same language area, with the majority coming from Turkish-speaking regions (24 families) and others from a wide range of further cultures and languages. In families in which only one parent was nonnative German-speaking, the most frequently represented language (11 persons) was English.

In families in which only one parent was nonnative German-speaking, the majority (66%) used only German most of the time in everyday family life at the beginning of the BiKS-3-18 study. In contrast, in families in which both parents were nonnative German-speaking, the majority (about 65%) used only or mostly the other language in everyday family life at the beginning of the BiKS study (see, for more details, Dubowy et al. 2008 and Fig. 2). Thus, in families in which one parent was nonnative German-speaking, the language of this nonnative parent seems to play a minor role in everyday language. This suggests that most children in this group grew up speaking German more or less monolingually. In contrast, in families in which both parents were nonnative German-speaking, most children seem to grow up monolingually as well, but not in the majority language German. Thus, our data suggest that most of the children growing up with two nonnative German-speaking parents start to learn German more intensively when entering German preschool. However, we do not know about this in more detail. Unfortunately, the BiKS-3-18 study does not give more information on whether and to what extent the children grew up bilingually. In addition, our groups are rather small and thus, we use one or two parents nonnative German-speaking as a (rather) crude indicator for differences in language environments within the family.

Families also varied widely in their social backgrounds. Overall, the parents' socioeconomic status (SES) and education were significantly lower among children with a bilateral nonnative German language background compared to the other two groups. Although there were about the same number of mothers with a high school diploma (or a comparable qualification) among these children as among the monolingual German families included in the study (33.3% vs. 34.3%), there were significantly more mothers in the first group who had no school-leaving certificate (6.1% vs. 0.7%) or only a lower secondary school leaving qualification (31.8% vs. 22.5%). Children with only one nonnative German-speaking parent were more similar to those with two German-speaking parents in terms of socioeconomic background. However, the first tended to have, on average, slightly higher educational qualifications and a higher International Socio-Economic Index (ISEI; cf. Ganzeboom and Treiman 1996). For more detailed information on the sample, see Table 1 and also Dubowy et al. (2008).

Table 1 Means (M) and standard deviations (SD) of the International Socio-Economic Index (ISEI) of mothers and fathers and the respectively highest ISEI as a function of parents' native language

Mother tongue parents	ISEI mother *M (SD)*	ISEI father *M (SD)*	ISEI highest *M (SD)*
Both parents German	47.32 (15.17)	49.62 (16.62)	53.97 (15.83)
One parent not German	48.69 (13.41)	47.85 (19.18)	54.79 (16.14)
Both parents not German	36.08 (12.91)	32.98 (13.98)	38.75 (13.20)

2 Competencies at the Beginning of the Preschool Years

We first look at the performance of children with different language backgrounds in the various areas of competencies examined in the BiKS-3-18 study (grammar and vocabulary in German, verbal working memory, nonverbal cognitive abilities, factual content knowledge) at the beginning of preschool. The BiKS-3-18 study demonstrated that children whose parents both had a mother tongue other than German showed—as a group—comparatively more limited results on competence measures at the age of about 3 years compared to the other groups of children, especially in tests requiring relatively rich language skills in the majority language German (see Fig. 1). Statistical analyses (see Dubowy et al. 2008) revealed that even after controlling for their parents' SES, children with two nonnative German-speaking parents differed significantly from children growing up monolingually German as well as from children with one nonnative German-speaking parent in terms of grammar, vocabulary, and factual content knowledge. These

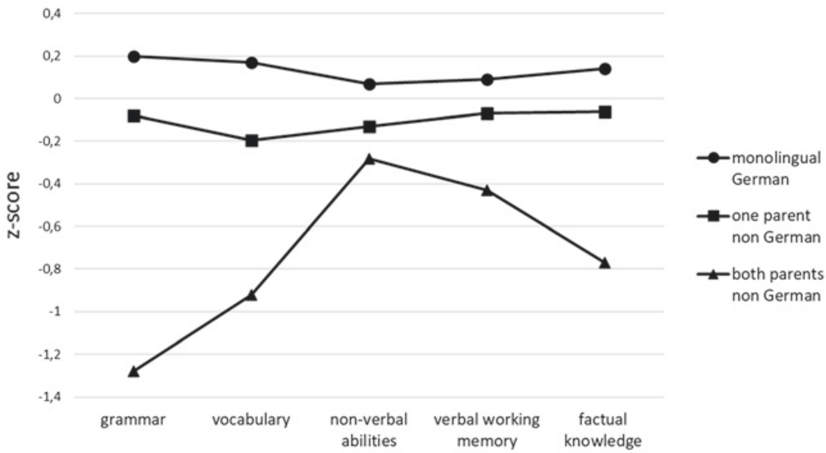

Fig. 1 Children's performance (mean z score) in grammar, vocabulary, basic nonverbal abilities, verbal working memory, and factual knowledge at the age of about 3 years (Measurement point 1) depending on parents' language background (figure based on Dubowy et al. 2008, p. 127)

measures were all assessed in the German language. In contrast, differences in basic nonverbal cognitive abilities and verbal working memory were, as expected, small and could be attributed to individual subtests and possibly to the language of instruction, which was German. For example, differences in basic nonverbal abilities were found only in the subtest ‘Categories’ of the SON-R 2½-7 (Tellegen et al. 2005), but not in the subtest ‘Analogies’. This might be explained by the fact that the processing of categories is often influenced by language (see, for more information, Weinert 2004b, 2008). Also concerning verbal working memory, the limitations could be attributed only to the subtest ‘Phonological memory for nonwords’ from the SETK 3-5 (Grimm 2001) that contains pseudowords resembling German phonology.

Although the performance of children with only one nonnative German-speaking parent was in the range of the performance of monolingual German-speaking children in most tests, they still differed from them in some language-related tasks such as vocabulary (cf. Dubowy et al. 2008). Similar results have been reported in other studies with bilingual children, although the reasons for the slight disadvantages of this group are not clear (e.g., Bialystok 2009). Yet, at least some of these children probably learned more than one language (and thus more than one vocabulary) with less time-on-task for each language. However, note that—particularly in this group—the specific language learning conditions were rather heterogeneous. They may have varied substantially depending on, for example, the value the family placed on promoting the native language of the parent rather than the majority language.

3 Language Use in the Family and Perceived Integration into Society Among Families with Another Language Background Than German

Differences in the conditions of language acquisition in children from families with different language backgrounds could be observed when considering the language spoken in the family when all family members are together (everyday family language). In the BiKS-3-18 study, families with only one nonnative German-speaking parent stated mostly that they spoke only German when all family members were together (66%). For children with two nonnative German-speaking parents, the parents’ language of origin often played a much greater role in everyday family life. Of these families, 24.1% reported speaking mostly, and 40.9% exclusively, a language other than German when all family members were together. In most of the remaining families in this group (27.3%), partly the majority language and partly the language of origin was reported as being the everyday family language, whereas in only a very few cases was German said to be spoken more frequently than the language of origin (see Fig. 2a).

Competencies in the majority language are often assumed to be the key to integration into a foreign society, especially in EU policy (e.g., Ros i Sole 2014). However, it is questionable whether this assumption holds empirically. Nonetheless, Johnson and Newport (1989) reported a significantly positive correlation of $r = 0.63$ between performance on an English grammar test and perceived integration in the US in adults after some years as second-language learners. Thus, for children's second or majority language development, the perceived integration of their family as an environmental factor may, on the one hand, reflect the language competencies in the majority language of the family and, on the other hand, act as an important external environmental factor for their language development. To the best of our knowledge, the impact of these external variables on children's language development has yet to be investigated.

The BiKS data shows that almost all families with only one parent who is not a native speaker of German, felt well integrated into German society. This is, of course, not surprising, because one parent is presumably originally from Germany. However, even in families in which both parents spoke a mother

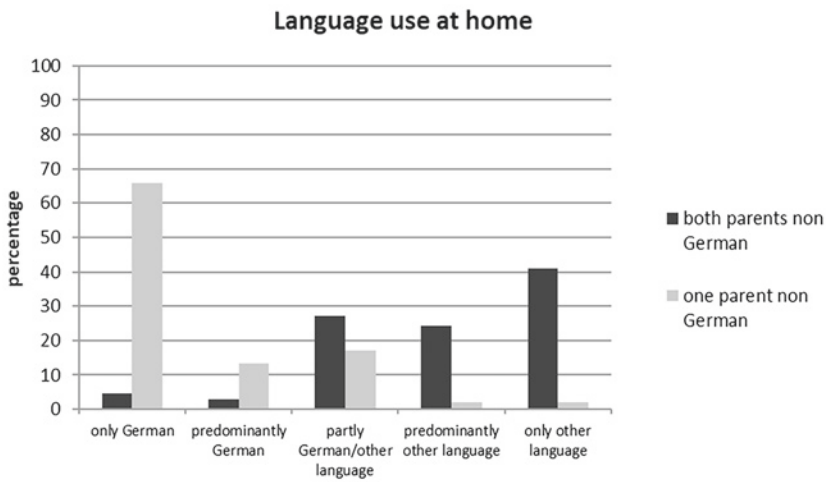

Fig. 2a Language spoken when all family members were together depending on family's language background

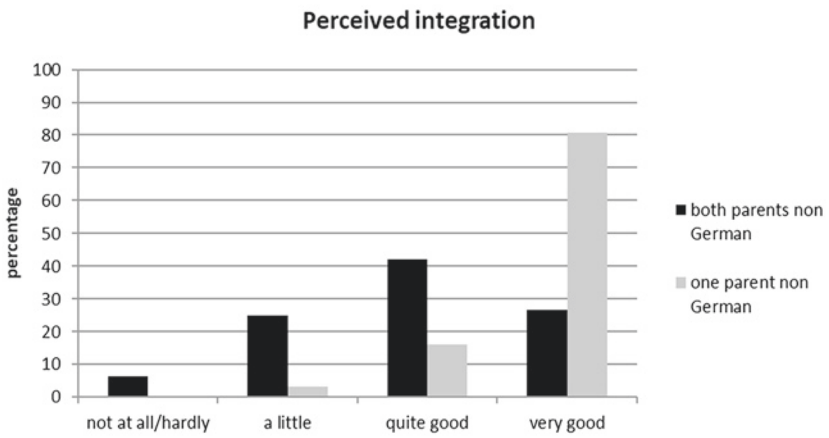

Fig. 2b Perceived integration into German society depending on family's language background

tongue other than German, the majority of this group felt fairly (42.2%) or very well (26.6%) integrated into German society (see Fig. 2b). This was the case, although—as shown above—they often used another language than German at home (i.e., mostly or exclusively used another language than German in everyday family life).

Since families in which both parents had a mother tongue other than German differed more in the language spoken in everyday family life as well as in the perceived integration into German society, it is particularly interesting to take a closer look at the German language development of their children.

Language use at home and competencies in children with two parents who have a mother tongue other than German. In line with Esser's (2001) time-on-task hypothesis of second-language learning (i.e., the assumption that (interactive) access to the language is of central importance for acquiring that language) statistical analyses of the BiKS-3-18 data showed that—after controlling for age and socioeconomic status—children growing up in families who predominantly or mostly spoke another language than German at home were significantly poorer in comprehending German sentences (receptive grammar) than the other children. On a descriptive level, these children also showed greater limitations in (German) vocabulary and verbal working memory compared to children who spoke German at least partially in their homes (cf. Dubowy et al. 2008; see Fig. 3).

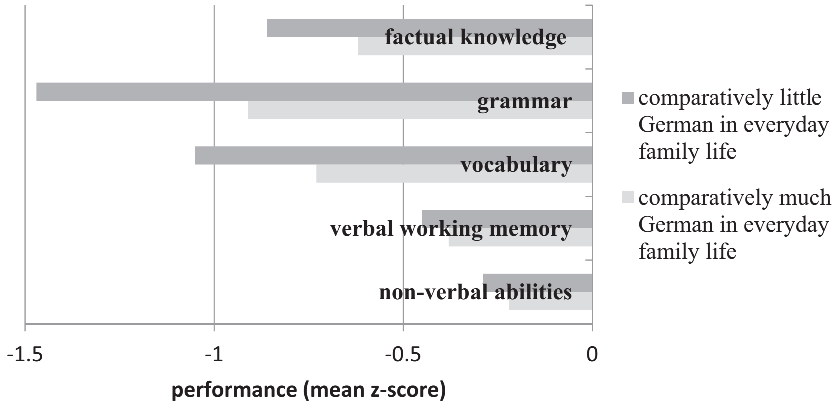

Fig. 3 Families in which both parents have a mother tongue other than German: Children's test performance (mean z score) at age of about 3 years (Measurement point 1) in factual knowledge, grammar, vocabulary, verbal working memory, and nonverbal abilities (recorded in German) depending on language use at home

However, it must be taken into account that we do not know how well the parents could speak German. It might be that parents with higher German language proficiency used German more often at home. Accordingly, we are not able to judge whether the apparent advantages of German language use within the family (see Fig. 3) could vary with or depend on the German language competence of the parents. Thus, not only the quantity but also the *quality* of German language stimulation may play a role in German language acquisition in children from families with a nonnative German language background. This can also be concluded from a study by Lehrl et al. (2012). Their analyses of data from the BiKS-3-18 study showed that the family's language background had also significant indirect effects on children's (German) language skills (grammar, vocabulary) and their factual knowledge (assessed via the German language). Thus, the effect of the parents' language background (i.e., whether both, only one, or none of the parents had German as her or his mother tongue) was partially mediated via the *quality of (verbal) parent–child interactions* and the *experience with books*. The *quality of parent–child interaction* was measured by a live rating of a semistandardized picture book situation. This rating refers, for example, to the use of questions, conversational shares, and the level of free speech. *Experience with books* was assessed via parent report on the number of children's and adults' books and the frequency of reading aloud to the child (see also Rossbach et al. this volume). When the quality of the parent–child interaction was included in the model, only indirect effects of language background on the change in receptive (German) vocabulary and factual knowledge between the ages of 3 and 4 years were found. Concerning the development of German grammar reception between the ages of 3 and 4, indirect effects were also observed. In this case, effects were partially mediated through the experience with books. However, a direct effect of the parents' language background remained—although it did weaken (see for more details Lehrl et al. 2012).

Overall, the results of the BiKS-3-18 study suggest that language stimulation at home plays an important role in the acquisition of the majority language in children with a nonnative German language family background. However, the results cannot be used to conclude simply that the quantitative use of German in the family is decisive for comparatively better German language development. For example, even among children with nonnative German-speaking parents who predominantly or mostly used another language than German in everyday family life, at least half of them spoke German well to very well, according to their parents. Further, in the objective language tests, these children indeed showed comparable German language skills to children from nonnative German-speaking families whose parents reported using German at least partly in everyday family life. After controlling for the mean ISEI of the parents and the age of the children, there were no statistically significant differences between these two subgroups (i.e., between children with comparatively little use of German in everyday family life, but good German language skills according to their parents' claim vs. comparatively much German in everyday family life) in any of the competence areas tested (factual content knowledge, grammar, vocabulary, verbal working memory, nonverbal cognitive abilities, $F(5, 33) = 1.94$, $p = 0.23$[2]).

Findings on language use at home should not obscure the fact that, regardless of which language is spoken at home, all children for whom both parents were nonnative speakers of German were limited in their German language skills at the age of 3—that is, at an age when monolingual German-speaking children also are still making substantial progress in language acquisition. Thus, these children may be disadvantaged in their educational opportunities (cf. also Hoff 2013). However, besides the language used in everyday family life, other factors could also play a role in children's acquisition of the majority language. For example, as Klein (2000) has shown, individual preconditions and motivations in learners are also important over and above the language input they receive. Thus, which

[2] Result of a multivariate analysis of variance.

recommendations can be derived from the BiKS findings remains an open question. A simple conclusion that speaking German in a nonnative German-speaking family would be beneficial in every case is not possible, especially because the effects on the children's (second) language acquisition may vary depending on the parents' German language proficiency.

Perceived integration into society and competencies in children whose both parents have a mother tongue other than German. As mentioned above (see Fig. 2b), not only families in which one parent was a nonnative speaker of German but also the majority of families in which both parents were nonnative German speakers felt to an overwhelming extent well to very well integrated into German society. At the same time, within this group, it were especially those children growing up in families that did not feel integrated into German society (not at all or only hardly) who showed significantly poorer performance on factual knowledge (recorded in German) and German grammar at age 3 compared to children from families that felt comparatively well integrated into German society. This held even after controlling for the parents' ISEI and the children's age (cf. Dubowy et al. 2008). However, the perceived integration of the group in which both parents spoke a native language other than German correlated with the language spoken in everyday family life to only a small degree (rank correlation according to Spearman's rho: $r = 0.19$, *ns*). This means, for example, that families who felt well integrated into German society did not necessarily speak more German at home than families who felt less well integrated. Conversely, families who spoke more German in everyday family life did not necessarily feel better integrated into German society. However, as the BiKS-3-18 study showed, both aspects (language spoken in the family and perceived integration into society) related to the children's majority language skills: Children from families who felt less well integrated showed limitations in (German) language or (German) language-related other competencies as did children from families in which comparatively little German was spoken.

Against this background, the question arises whether the parents of children with comparatively good German language competencies felt better integrated into German society, even when they spoke comparatively little German at home. To answer this question, we took a closer look at the perceived integration into society of families who stated that they spoke comparatively little German at home: We compared their perceived integration as a function of whether their children showed comparatively advanced or less advanced German language skills. After controlling for ISEI and the age of the children, we found no statistically significant difference in perceived integration into society, $F(1, 38) = 0.74$, *ns*. Thus, the perceived integration of the family did not explain why some children, although they received little German language stimulation at home, showed comparatively better German language skills. Consequently, other explanatory variables must be taken into account. Possible explanations could be special linguistic or cognitive prerequisites on the part of the children (internal factors) or the German language stimulation that these children experience outside the family (external factors).

4 Changes Over the Preschool Years in the Language Spoken in the Family, in the Perceived Integration into Society, and in the Children's Majority Language Skills

In the following, we ask about the changes over the preschool years that can be observed in the various factors considered so far: How does the use of German in everyday life change in families when parents have a mother tongue other than German? How does the perceived integration into society change over time? What does the children's German language development look like? Do the children with clear limitations in their German language competencies at the beginning of preschool catch up with their peers who grow up monolingually, or is the achievement gap widening (Matthew effect)? Furthermore, we ask whether there are internal factors such as individual child abilities and skills or external factors such as the quality of language stimulation in preschool that are particularly conducive to the majority language development of children living in families with non-majority language backgrounds?

Changes in everyday language use in families when both parents have a mother tongue other than German. We first looked at the changes in families' everyday language use over the preschool period in families in which both parents had a mother tongue other than German (Fig. 4).

Figure 4 shows that for those children for whom valid data were available at all three measurement points ($N=45$),[3] the proportion of families who stated that they used only the language of origin in everyday family life was significantly lower at MP 5 when children were about 5 years old compared to age 3. Like-

[3] The everyday language in the family at Measurement point 1 did not differ significantly between the group of persons for whom data on everyday language were available at all three measurement points ($N=45$) and the group of persons for whom data were not available at all three measurement points ($N=21$), $t(64)=-1.63$, $p=.11$.

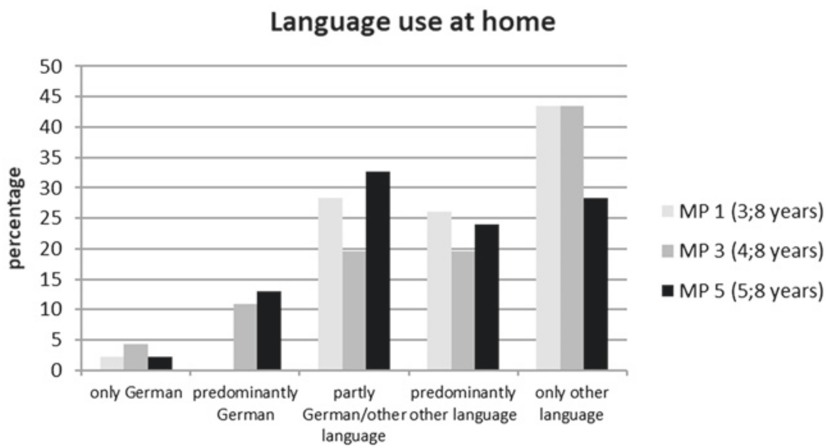

Fig. 4 Frequency of German vs. other language spoken in the family when all family members are together at the ages of 3, 4, and 5 years (Measurement point (MP) 1, 3, and 5) in percent for the children whose parents both speak a mother tongue other than German and from whom data were available for all measurement points (N = 45)

wise, the proportion of families who mostly spoke German increased over time (see Fig. 4). This suggests that the children increasingly introduce the majority language of the society in which they live to the families, probably through their preschool attendance.

Changes in perceived integration into society when both parents have a mother tongue other than German. Next, we looked at changes during preschool years in the perceived integration of the families in which both parents had a mother tongue other than German. For those families from which data on perceived integration were available at all three measurement points ($N = 40$),[4] we found that the proportion of people who felt fairly well integrated into German society increased over the preschool period. However, at the same time, the proportion reporting that integration into society was perceived as very good decreased (see Fig. 5). The reason for this result and the extent to which language

[4] Perceived integration at Measurement point 1 did not differ significantly between the group of persons for whom data on integration were available at all three measurement points ($N = 40$) and the group of persons for whom these data were not available at all three measurement points ($N = 24$), $t(62) = 1.00$, $p = .32$.

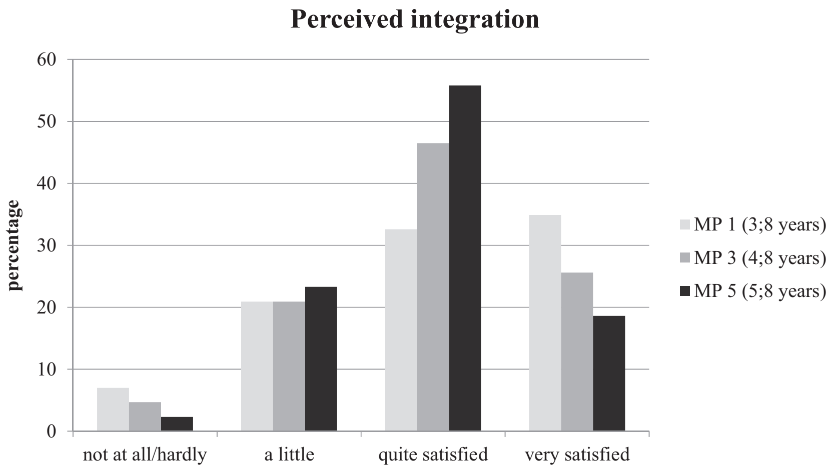

Fig. 5 Perceived integration of family when children aged 3, 4, and 5 years (Measurement point (MP) 1, 3, and 5) for families in which both parents spoke a mother tongue other than German and for which information was available at all three measurement points (N = 40)

proficiency in the majority language and the increasing contact with the German education system (i.e., attendance at preschool) might have played a role must remain open at this point.

Majority language development in children of parents who both had a mother tongue other than German. Although, as expected, those children whose parents both had a nonnative German language background were comparatively limited in their German language competencies at age 3 (see above), interestingly, 39.7% of the parents in this group stated that German was the language their child spoke best. This percentage even rose during preschool years: At the age of 4 years, 58.6% and, at the age of 5 years, even 82.1% of the parents were convinced that their child spoke German better than the language of origin. Consequently, the mastery of the majority language German is becoming increasingly dominant over that of the parents' native language.

Vocabulary development in German. In the BiKS-3-18 study, we found that on a German research version of the Peabody Picture Vocabulary Test (PPVT-R; Dunn and Dunn 1981), 5-year olds whose parents were both nonnative speakers of German assigned, on average, almost three times as many words correctly to the corresponding picture compared to the first measurement point in the BiKS-3-18 study. Thus, their German vocabulary (performance on a receptive vocabulary

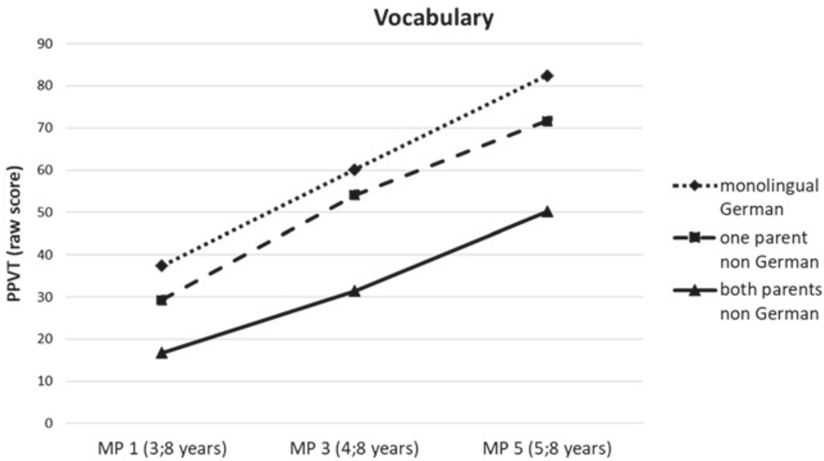

Fig. 6 Scores on the vocabulary test (PPVT) at Measurement points (MP) 1, 3, and 5 depending on family's language background

test) tripled between the ages of 3 (MP 1) and 5 years (MP 5). As Fig. 6 shows, however, the vocabulary of the monolingual German children participating in BiKS-3-18 also increased over the preschool years. Thus, at the age of 5 years, the differences in the number of correctly assigned pictures in the vocabulary test between the three groups (children with no, one, or two nonnative German-speaking parents) were even greater than at age 3 (see Fig. 6). Latent growth curve models depicting the achievement growth of the individual children confirmed that the children with two nonnative German-speaking parents showed not only a more limited German-language vocabulary at age 3 compared to the monolingual German children ($b = -1.42$, $p < 0.01$), but also had a smaller vocabulary growth ($b = -0.83$, $p < 0.01$) until age 5 (cf. Ebert et al. 2013).

Thus, the gap in German vocabulary did not close following German preschool attendance but continued to widen. However, in our sample, it is not possible to test whether the gap would have widened even further if children had not attended preschool. This further widening is suggested by other findings in the literature (cf., e.g., Sammons et al. 2002).

Our analyses of the BiKS-3-18 data showed further that children with only one nonnative German-speaking parent also started preschool at a lower vocabulary level than monolingual German children ($b = -0.47$, $p < 0.01$); yet in contrast to children whose parents both had a different mother tongue than German, they

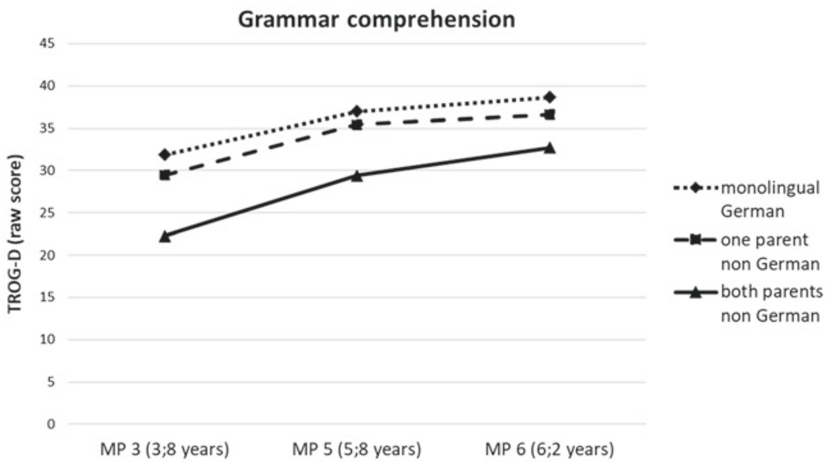

Fig. 7 Scores on the grammar comprehension test (short form TROG-D) at Measurement points (MP) 3, 5, and 6 depending on family's language background

did not show reduced growth ($b = -0.04$, ns) compared to monolingual German children (Ebert et al. 2013).

Grammar acquisition in German. Figure 7 shows the children's performance on a short German version of the *Test for the Reception of Grammar* (TROG-D, Fox 2006) as a function of their language background. This test presents children with German sentences of varying grammatical complexity, and their task is to select the one out of four pictures that matches the respective sentence. In the BiKS-3-18 study, the test was administered at the ages of 4;8 (MP 3), 5;8 (MP 5), and 6;2 (MP 6). Figure 7 shows that the grammar (sentence comprehension) in German acquired during preschool years was particularly limited for children whose parents both had a mother tongue other than German compared to the other two groups (monolingual German children and children with only one non-native German-speaking parent). However, at the end of preschool (MP 6) differences between groups in raw scores on the TROG-D were smaller than at the age of 4;8 years (MP 3). Thus, children whose parents were both nonnative speakers of German seemed to make up some ground during their preschool years in German sentence comprehension (receptive grammar). This result differs from what we found for German vocabulary development.

Analyses of variance and latent growth curve models confirmed these descriptive findings: A repeated measures analysis of variance across the three measurement points, controlling for social background (mean ISEI of parents) and age of the children, showed a significant main effect of language background, $F(2, 430) = 43.38$, $p < 0.01$, as well as a significant interaction between language background and time, $F(200.40, 801.41) = 4.09$, $p < 0.01$. This can probably be explained by the fact that the children with two nonnative German-speaking parents—at least for rather basic language patterns—caught up over time with the other two groups. This assumption was also confirmed by latent growth curve models. Here, we found that children with two nonnative German-speaking parents showed more limited performance ($b = -9.58$, $p < 0.01$) compared to the monolingual German children at the age of 4;8 years, but, at the same time, showed a stronger growth over time ($b = 1.18$, $p < 0.01$). However, these findings should be interpreted with caution, because the size of the significant interaction effect in the analysis of variance was extremely low. Moreover, the convergence of test performance of the children with nonnative German-speaking parents to the other groups seemed to be due more to the slower growth of the latter (see Fig. 7). The children from monolingual German families seemed to have reached a basic grammatical level at the end of the preschool years, so that a further linear increase in grammar could simply no longer be observed. Instead, more complex grammatical structures and meanings must now be acquired. At the same time, it should be noted that most children with two nonnative German-speaking parents did not seem to have reached this basic grammatical level in German by the end of preschool. Accordingly, they differed at this point from children with only one nonnative German-speaking parent as well as from monolingual German children, even after controlling for family socioeconomic status as measured by the highest ISEI in the family (see Kotzerke et al. 2013).

Even during primary school years, the grammatical skills in German (sentence comprehension) of children with two nonnative German-speaking parents were, on average, limited compared to monolingual German children. For example, in 1st grade, this was even true for comparatively simple sentence constructions that have already been mastered easily by almost all monolingual German children as well as by children with only one nonnative German-speaking parent. However, the disadvantages of children with nonnative German-speaking parents were particularly pronounced when it came to comparatively complex grammatical structures (see Fig. 8; for more information, see Kotzerke et al. 2014).

Whereas the disadvantage in understanding simple grammatical structures disappeared by the end of Grade 3, limitations in understanding comparatively complex grammatical structures still remained at this time (see Fig. 9; for more information, adapted from Kotzerke et al. 2014).

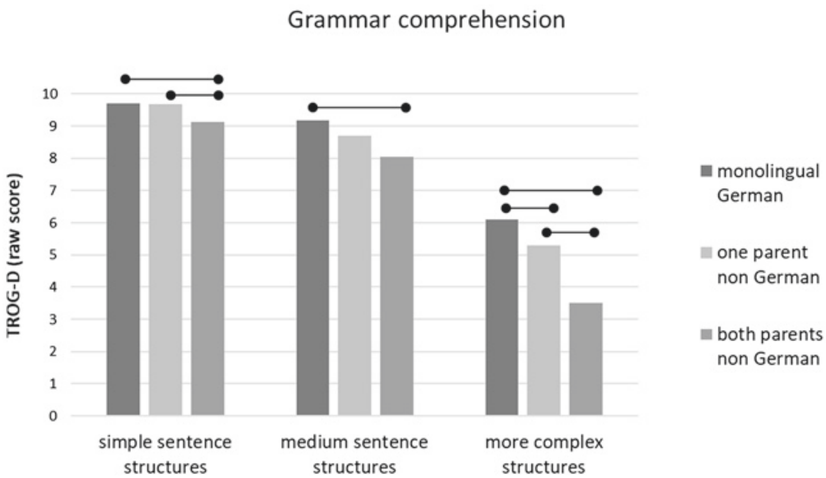

Fig. 8 Mean scores achieved in 1st grade in German sentence comprehension differentiating between items of simple, medium, and more complex sentence structure of the TROG-D (max. score each = 10) depending on family's language background (crossbars mark statistically significant group differences) (adapted from Kotzerke et al. 2014, p. 81)

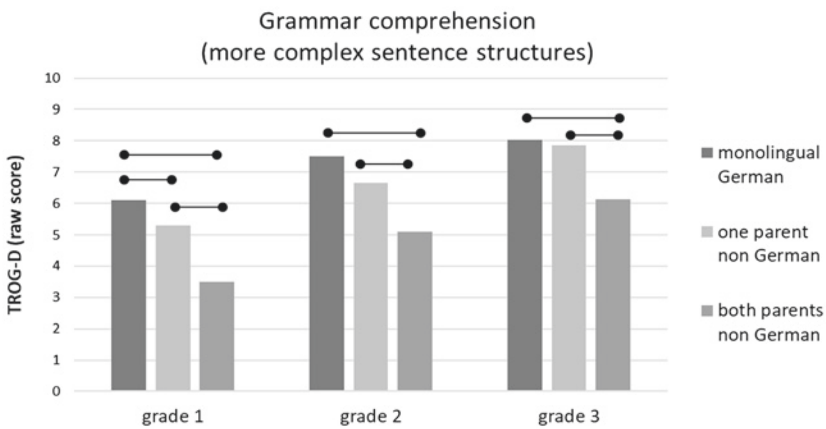

Fig. 9 Mean scores on comparatively complex grammatical sentence constructions of the TROG-D (max. score each = 10) depending on family's language background (crossbars mark statistically significant group differences) at Grade 1, 2, and 3 (adapted from Kotzerke et al. 2014, p. 82)

5 Factors Related to (German) Language Development in Preschool Years

So far, the BiKS-3-18 study has shown that children whose parents have a mother tongue other than German are comparatively disadvantaged in their German language development at preschool age. This disadvantage may also limit their opportunities in the German education system (see also Weinert and Ebert this volume). Thus, it is necessary to ask which factors explain these interindividual differences in German language development over the preschool years. In particular, one may ask which skills and abilities on the part of the child play a role (internal factors; see also Weinert and Ebert this volume), and which factors in the family and the preschool setting (external factors) support the children's language development (see also Lehrl et al. this volume).

Concerning *internal factors* that may be related to vocabulary development in the majority language German, latent growth curve models using BiKS-3-18 data showed—in line with theoretical assumptions—that in children with non-native German-speaking parents, differences in verbal working memory had a significant effect on vocabulary growth over the preschool years. Advanced verbal working memory performance at the age of 3 was associated not only with comparatively more advanced vocabulary knowledge in German but also with a steeper vocabulary growth in German between the ages of 3 and 5 (cf. Ebert et al. 2013). This finding is in line with results reported by Gathercole and colleagues (e.g., Gathercole and Baddeley 1993; Gathercole et al. 1992). They documented, for example, that the interindividually different capacity of phonological working memory plays a central role in vocabulary development, especially in the early phases of vocabulary acquisition. Converging with this assumption, the results of the BiKS study showed that this phenomenon also applies to vocabulary development in a second language (cf. Ebert et al. 2013).

Concerning *external factors* related to children's language development, the previous sections have shown that in children whose parents have a nonnative German language background, *external factors* within the family such as the perceived integration of the family as well as the language used in everyday family life related to the children's (German) language competencies. Children whose families felt less integrated as well as families who spoke less German at home showed, on average, significant limitations in German vocabulary and grammar (sentence comprehension) at the beginning of preschool.

Other analyses within the BiKS research group on the effect of *external variables in the family* such as the family's SES and the literacy stimulation at home showed that overall the literacy stimulation at home—measured via questionnaires (e.g., stimulation through books) and via observation and qualitative ratings of German language stimulation during a picture book situation (Family Evaluation Scale (FES), Kuger et al. 2005)—related to differences in children's German vocabulary and mediated the effects of the family's SES on vocabulary at age 3 (cf. Ebert et al. 2013; Weinert and Ebert 2013). However, there was no general effect of differences in literacy stimulation at home on the growth of German vocabulary over the preschool years. Nonetheless, we found that after controlling for the family's SES, the effect of verbal working memory on vocabulary growth in German was reduced for children with a nonnative German language background. This suggests a covariation between child and family variables, which is also proposed by bioecological and interactionist theories of development (Bronfenbrenner and Ceci 1994; Lerner et al. 2005).

With respect to *external language promoting factors* in the preschools, contrary to our expectations, latent growth curve models revealed hardly any effects on children's vocabulary (cf. Ebert et al. 2013; Weinert et al. 2012). Observed differences in neither structural quality (e.g., group size, educator–child ratio) nor the measured process quality of the preschool (literacy and language support) had a significant effect on the vocabulary development in children with a native or nonnative German language background.

For example, latent growth curve models in the group of children with a nonnative German family language background showed marginally significant effects of differences in literacy stimulation in preschool as well as of the presence of special language support programs in preschool on the children's German vocabulary at the age of 3 years, but no effects on vocabulary growth over the preschool years (Ebert et al. 2013). The effects of literacy stimulation (as measured by the ECERS-E: Early Childhood Environment Rating Scale—Extension; Sylva et al. 2010; German Version: KES-E; Tietze et al. 2005; see Rossbach et al. this volume) revealed that higher levels of stimulation in preschool were associated with better German vocabulary, whereas special language support programs were more likely to be present when the children had lower vocabulary. On the one hand, this suggests that the quality of literacy stimulation may also depend on the children's (German) language level and, on the other hand, that preschools recognize the need for language support and offer more language support programs when the children attending show a very limited vocabulary.

Another finding was that the proportion of children in preschool with a migration background was associated with the initial German vocabulary score of children who had nonnative German-speaking parents. The proportion of children in preschool with a migration background also had a marginally significant negative effect on their vocabulary growth in German. However, this effect disappeared when family background variables were taken into account (see Ebert et al. 2013). This suggests that children with a nonnative German language background who attend preschools with a higher share of peers with a migration background show greater limitations in vocabulary at the age of 3, and, in some cases, also a slower growth (Ebert et al. 2013). One explanation for this result may be that the language stimulation in German from peers and teachers in preschools with a higher migration rate is reduced for the single child and qualitatively less demanding and less stimulating. This may be especially problematic for children's language development in the majority language when language stimulation and the language level of the majority language in the family is rather low (cf. also Mashburn et al. 2009, on the importance of language stimulation by peers).

Interestingly, concerning another aspect of the preschool environment, the BiKS-3-18 study revealed effects of the preschool (or more precisely: of differences between preschools) on the vocabulary acquisition of children with a nonnative German language background—that is, differences in the attitudes of preschool teachers toward first-language integration related to the vocabulary development of children with a migration background (cf. Kratzmann et al. 2013). Children with a migration background (determined here based on the parents' and grandparents' country of birth) who experienced little German language stimulation in everyday family life (i.e., most children whose both parents had a mother tongue other than German) or who were in preschools with a high migration rate showed a slower development of German vocabulary when the preschool teachers considered first-language integration approaches to be particularly valuable (i.e., agree, for example, with the statement: "In every preschool, there should be bilingual programs for migrant children"). Against the background of Esser's (2001) assumption that interethnic social contacts and the associated educational opportunities are of central importance for German language development, the findings can be explained by the fact that educators who advocate first-language-integrating approaches may also increase the inclusion of the first language in everyday preschool life. As a consequence children who experience little German language input at home (e.g., because the parents themselves had limited German language proficiency) or in preschool (e.g., because the majority of playmates also had limited German language skills) may additionally be restricted in German-language-learning opportunities.

The findings from the BiKS-3-18 study showed that language and literacy support in preschool for German language development in all children is anything but trivial (e.g., Ebert et al. 2013; Weinert et al. 2012; Weinert and Ebert 2013). Hence, the study confirmed and extended findings revealing that the effects of language support in institutional contexts often fall short compared to the effects that can be expected from a theoretical and empirical perspective (e.g., Roos et al. 2010; see Lehrl et al. this volume).

6 Summary and Outlook

The present chapter aimed to learn more about how social disparities in children with a migration background develop while bringing together key results of the BiKS-3-18 study on the development of preschool children with a nonnative German language background in their family. One focus was on language development in the majority language German in children whose both parents have a mother tongue other than German. Results show that these children are disadvantaged in German language development, especially when the everyday language in the family is not German or when the families feel less integrated into German society. However, it should be noted that the BiKS-3-18 study cannot give information about the children's productive language competencies in German. In addition, a simple conclusion that the mere offer of German in the family is beneficial in every case, cannot be drawn from our data. Hence, for example, we also found that about half of the children in whose families German is rarely used as the everyday family language are comparable in their German (receptive) language development to those children in whose families German is predominantly or mostly the everyday family language. Moreover, our results suggest that the quality, and not the pure quantity, of German language interaction promotes the children's majority language development. Thus, the home language environment (frequency of books and reading, German language stimulation during a semi-standardized book reading task) mediates part of the effect of the language background on German language development. Although we have no direct data on the parents' own German language competencies, these results suggest that these play a major role in the development of German language competencies in their children.

Interestingly, the use of German as their everyday language and perceived integration correlate only marginally. This means that the use or nonuse of German as an everyday language is not a clear sign of a good or not-so-good integration into German society—at least from the perspective of the families themselves. Moreover, the perceived integration of the family does not explain why some children, despite receiving little German language stimulation at home, show comparatively better German language skills. However, although only slightly correlated, both the proportion of families who mostly use German as an everday language as well as the proportion of families who perceive good integration increased over the preschool years. This suggests that with preschool attendance, children bring the majority language increasingly into their family life. However, the perceived integration seems to become more realistic as the proportion perceiving a very good integration also decreases. We assume that these changes in perceived integration and language use at home also promote the German language development of the children. However, it is not possible to connect these changes directly with changes in German language development, because our sample is too small. This will have to be investigated further in future studies. Yet, more than 80% of the parents say that their children perform better in German than in the other language(s) at the end of preschool; whereas at the beginning of preschool, it was only 40%.

The BiKS-3-18 study also considered other explanatory variables for children's (German) language competencies (see also Weinert and Ebert this volume). Thus, further results of the BiKS-3-18 study show that internal factors such as verbal working memory are also an important explanatory factor for children's language development in the majority language when they grow up with more than one language. Moreover, in line with the bioecological and interactionist theories of development (Bronfenbrenner and Ceci 1994; Lerner et al. 2005), internal factors seem to covary with external factors within the family. Thus, for example, the effect of verbal working memory as an internal factor was reduced after controlling the family SES.

Regarding the external environmental factors that children experience outside the family in preschool, the BiKS-3-18 study reveals hardly any effect of German language and literacy stimulation on children's language competencies. At first glance, this seems surprising. Explanations for this finding may be that the quality of support in the almost 100 preschools surveyed in the BiKS study was, on average, not very high, and thus possibly too low to demonstrate an effect on development. In addition, the differences between the preschools in literacy stimulation were not very pronounced, and thus possibly too limited to produce effects. Another explanation is that the chosen measure of literacy stimulation may have been too unspecific, and that the requirements for promoting language development are more demanding than what could be reflected in the relatively unspecific literacy measure provided by the ECERS. Thus, other studies demonstrate that, for example, more specific measures of language stimulation such as specific features of the language input of parents or teachers show effects on children's vocabulary and grammar acquisition (e.g., Huttenlocher et al. 2002).

Overall, the findings of the BiKS-3-18 study on the development of children with a nonnative German language background suggest that a lot needs to be done to compensate for their disadvantages in German language development, particularly with regard to the quality of preschools and the language support programs offered. Preschools need to take adequate account of the interindividual differences that children bring with them as well as the differences in language stimulation they receive at home. It should be noted that this applies not only to children with a nonnative German language background but also to monolingual German children from low-SES families (see Weinert and Ebert this volume; Weinert and Ebert 2013).

It should be emphasized that the BiKS-3-18 study could shed light on only a few facets of children's language development in the majority language. For example, the present findings relate predominantly to the development of (German) receptive vocabulary and receptive grammar. The extent to which internal and external factors relate to other facets of language development remains to be clarified. Differential effects and complex interactions between the home learning environment, preschool quality in general, and the quality of instruction in particular may depend on the specific developmental domain under study (see also Ebert et al. 2020; Lehrl et al. this volume). Moreover, the BiKS study observed only the German language development of the children without focusing specifically on the development of the language of family origin and possible advantages of multilingualism. However, in German language development, the findings of the BiKS-3-18 study show that especially for children with limited access to (German) language at home, preschools have an important role to play in learning the majority language. Nonetheless, much research is still needed to clarify how to design effective (German) language support in preschools.

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Fostering Early Competence Development Through Home and Preschool Learning Environments—a Summary of Findings from the BiKS-3-18 Study

Simone Lehrl, Hans-Günther Rossbach and Sabine Weinert

Abstract

Growing evidence reveals powerful associations between early learning environments and children's later academic success. Besides the family, which has been shown to be a significant predictor of children's development, the longer-term benefits of early institutional experiences in the preschool are also of interest, given the high participation rate across all social milieus, and the continuously expanding sector of early childhood education and care. In this paper, we therefore present findings from the study BiKS-3-18 on the short- and long-term effects of early learning environments at home and at preschool on children's development.

The results show that the quality of the home learning environment as well as the quality of the preschool have long term benefits for children's

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socio-emotional, language, and mathematical development, although not uniformly for different developmental domains and learning environments. Thereby, the results point to the specificity of environmental impact, as different facets of the learning environments predict different domains of children's development.

Keywords

Preschool quality · Early childhood education and care · Home learning environment · Mathematical development · Language development · Socio-emotional development · Longitudinal study · Developmental growth · Lasting effects

1 Introduction

From a bioecological perspective of human development, stimulating adult-child interactions within and between ecological micro systems are crucial for children's development (Bronfenbrenner and Morris 2006). In detail, engaging children in stimulating early learning opportunities at home and in institutions is associated with comparatively higher levels of cognitive, language, mathematical, and socio-emotional competencies with positive long-lasting effects on future academic achievement (Boonk et al. 2018; Dearing et al. 2006; Park and Holloway 2017). As a consequence, parents and teachers are encouraged to support learning, and to engage in stimulating activities with children to foster children's early development and later outcomes. It is well documented that children differ already at entry to preschool in their language, (pre-)reading, and early numeracy skills and that these differences often persist later in life (e.g., Dornheim 2008; Dubowy et al. 2008; Magnuson et al. 2004; Sammons and Smees 1998; Sammons et al. 2004; Tymms et al. 1997; Weinert et al. 2010; see also Weinert and Ebert this volume). Therefore, rather than solely relying on strategies implemented in primary and secondary school, it is important to investigate relevant influencing factors that affect children's development at an earlier age. Promoting school relevant competencies is hypothesized to be a means to raise achievement levels of all children, but may be especially relevant for children from disadvantaged homes. Issues of early education have also been widely discussed in other fields like economics (Heckman 2006; Knudsen et al. 2006) and it has been argued that investing in early education programs will result in long-term monetary benefits.

Such expectations have finally led to increased state and federal support for early education programs in Germany as well. The implementation of educational plans since 2004 across all federal states that explicitly define educational domains like language or science education marks one of these developments (e.g. Smidt and Schmidt 2012). Furthermore, additional strategies have been implemented recently to put a stronger focus on the promotion of domain-specific competencies like language development (e.g., the federal program "Language Daycare Centers: Because Language is the Key to the World") in preschool settings.

However, although there was an increased attention towards the early years there is still a lack of research in this area, especially in Germany, concerning—to name some—the lasting effects of the quality of early childhood education and care (ECEC) and the early home learning environment (HLE) on child development, the interaction between different environments in predicting child development, the moderating role of child factors, the domain-specificity of environmental impact, and the question of possible compensatory effects of early education for children at risk.

Thus, the early childhood education project together with the developmental psychology project of the BiKS-3-18 study investigated the short- and long-term effects of quality in ECEC and the early HLE on children's development. We specifically focus on domain-specific and domain-general effects, the interaction between the learning environments, and the moderating role of child and family factors. The present paper gives insights in research findings from the BiKS-3-18 study regarding how learning environments at home and at preschool shape the development of children's school relevant competencies from early preschool age onwards.

Starting from a brief sketch of the main theoretical and conceptual considerations and the respective state of research, we will report results on the effects of (1) the home learning environment (HLE), (2) the quality of preschools (ECEC quality), and (3) the combined effects and possible moderators on different domains of child development, particularly language, (pre-)literacy, and math development. Finally, we integrate the findings and discuss limitations and implications for further research and practice.

2 Theoretical Frame

Our research is guided by bioecological theory (Bronfenbrenner and Morris 2006). A fundamental premise of the theory is that over the course of one's life "human development takes place through processes of progressively more complex reciprocal interaction between an active, evolving biopsychological human organism and the persons, objects, and symbols in its immediate external environment" (Bronfenbrenner and Morris 2006, p. 797). The major interacting components of the bioecological model are processes, person, contexts, and time, with processes taking a central position as "engines of development" (p. 801). According to Bronfenbrenner and Morris (2006), proximal processes encompass interactions between individuals, as well as interactions with objects and symbols. To yield positive results, an individual needs to participate in these processes for an extended duration, allowing them to become progressively more intricate. These processes should be initiated by both the individual and the environment. Proximal processes have the capacity to diminish or offset disparities in developmental outcomes that arise from environmental variations (Bronfenbrenner and Morris 2006). Accordingly, within BiKS-3-18, learning environments at home and in preschools are seen as providers of proximal processes that shape children's development in interaction with the children's own (developing) capacities. Drawing on these theoretical assumptions, research within the BiKS-3-18 study provides a comprehensive approach to analyzing environmental effects that considers the (developing) individual characteristics of the child and the interplay between the learning environments over time.

3 The Home Learning Environment and Its Role in Shaping Children's Development

3.1 Theoretical and Conceptual Foundations

The observation of early emerging and rather stable disparities related to socioeconomic status (SES) for instance in early language and mathematical skills (see Weinert and Ebert this volume) as well as results showing a Matthew effect, i.e. an increasing gap in more sophisticated language skills in school age (e.g. Volodina et al. 2020), with a significant impact on school performance (Heppt et al. 2021; Schuth et al. 2017; Weinert and Ebert this volume), points to important influencing factors within the HLE. As assumed in bioecological models of development HLE could mediate such SES effects (e.g. Bronfenbrenner and Morris 1998). A huge body of research points to the importance of the early years HLE for children's development in various domains (see Lehrl 2018 for an overview) while concepts of HLE differ substantially. Most research applies a domain-specific approach in studying the effects of the home learning environment as suggested by Sénéchal and LeFevre (2002) for the language/literacy domain and Skwarchuk et al. (2014) for the mathematical domain. This aligns with the concept of child development having distinct trajectories for different domains, highlighting the importance of precisely assessing how the home learning environment influences various aspects of children's development. The domain-specific approach differentiates between activities related to literacy and numeracy within the home learning environment (e.g., Manolitsis et al. 2013). Whereas home literacy activities comprise activities that deal with oral and written language (e.g., shared book reading, teaching letters; Sénéchal and LeFevre 2002), home numeracy activities entail experiences regarding numbers, shapes, and digits (LeFevre et al. 2009). Within those two—still rather broad—domains, activities can be grouped into more formal (i.e., explicit teaching) and more informal activities (i.e., integrated in play). Formal literacy activities at home include those activities that directly refer to print, like teaching letters or reading (Sénéchal and LeFevre 2002). Accordingly, formal numeracy activities include all activities that directly teach numbers and counting (Skwarchuk et al. 2014).

Informal literacy and numeracy activities refer to experiences that involve language, print, or mathematics through process characteristics, stimulating activities, or input characteristics, e.g., during joint book reading or playing board games (Sénéchal and LeFevre 2002; Skwarchuk et al. 2014).

Furthermore, based on social-constructivist theory that suggests that children actively acquire higher cognitive skills by being supported by a more experienced person in their zone of proximal development (Vygotsky 1980), interaction quality can be conceptualised as those processes that stimulate and promote children's activities beyond their current cognitive and achievement level. In the context of shared book reading, extra-textual utterances of the parent might be a means to foster a child's cognitive and language level by going beyond the actual level of development and providing the child with stimulating input and interactions; this might be especially supportive for children's development (Lehrl, Ebert et al. 2020). The complexity (Huttenlocher et al. 2010) and grade of decontextualization of the language directed to the child during shared book reading seems to be especially important (e.g., van Kleeck 2003 for an overview). The most effective strategies for improving children's language and cognitive outcomes are asking open-ended questions (Ninio 1983), discussing the story, and elaborating on the child's comments in verbal interactions (de Jong and Leseman 2001; Hindman et al. 2008, 2014; Lehrl et al. 2013). These aspects tie also in with the concept of "sustained shared thinking" (SST; Siraj et al. 2017; Siraj-Blatchford et al. 2003). SST refers to "an interaction where two or more individuals 'work together' in an intellectual way to solve a problem, clarify a concept, evaluate an activity, or extend a narrative. Both parties must contribute to the thinking, and it must develop and extend the understanding" (Siraj-Blatchford et al. 2002, p. 8). Such kinds of dialogue are assumed to be particularly supportive to children's language and cognitive development by stimulating the child to actively engage in parent/teacher-guided situations.

Furthermore, within parallel research strands, routed in developmental psychology, even more specific indicators of verbal interactions—e.g., the parental mental state language—are discussed as important. In particular, language that is used to talk about mental states and processes (e.g., Bretherton and Beeghly 1982; Olson et al. 2006) is thought to promote the children's developing Theory of Mind (ToM) understanding, i.e., the understanding that human behavior is guided by mental states that may differ from reality (Ebert et al. 2017; Gola 2012; Ruffman et al. 2002).

In the domain of mathematics there is a small research branch conceptualizing the quality of interactions regarding mathematics as "math talk" (e.g., Klibanoff et al. 2006 for the classroom context; Levine et al. 2010; Ramani et al. 2015; Skwarchuk 2009). The findings indicated that the complexity and level of parents' and teachers' verbal expressions related to mathematics differ, such as when they mention numbers and digits, perform counting, discuss ordinal relationships, engage in calculations, identify numbers, and make comparisons between quantities and magnitudes. These variations, in turn, have a predictive impact on children's mathematical achievements (Klibanoff et al. 2006; Ramani et al. 2015; Skwarchuk 2009).

Within the BiKS-3-18 study, we were able to implement, amongst others, measures of formal and informal literacy, formal numeracy, the quality of overall verbal interaction and math talk (Lehrl, Ebert et al. 2020; see Rossbach et al. (this volume) for more information on the measures). Furthermore the amount and complexity of language input (Anderka 2018), and the parental mental state language (Ebert et al. 2017) was measured through high- and low-inferential ratings of observed parent-child-interactions including in-depth coding of video-taped and transcribed interaction situations (see Weinert and Ebert this volume) as well as via questionnaires. The scales used across the different studies thus differ in grades of specificity and will be further described at the corresponding passage of the paper.

3.2 Domain-Specific and Cross-Domain Effects of the Home Learning Environment

3.2.1 Home Literacy Stimulation and Language Development

Previous research shows in general, that the early home literacy environment is associated with children's language and literacy development (Sénéchal 2015).

Specifically, formal literacy experiences, such as teaching the alphabet, are associated with skills that precede or belong to decoding-oriented skills, like letter knowledge (Evans et al. 2000; Lehrl et al. 2012, 2013; Manolitsis et al. 2009; Torppa et al. 2006), later word decoding skills (Hood et al. 2008; Sénéchal and LeFevre 2002), and reading fluency (Sénéchal 2006). In contrast, informal literacy experiences are associated with skills that precede or belong to comprehension-oriented skills like children's vocabulary (Sénéchal and LeFevre 2002; Lehrl et al. 2012, 2013; Mol and Bus 2011; Sénéchal and LeFevre 2002; Torppa et al. 2006) and reading comprehension (Lehrl et al. 2013; Sénéchal 2006; Sénéchal and LeFevre 2002).

Regarding quality measures of verbal interaction behavior through observations, a huge body of research provides reasonable evidence that the quality of parent-child interactions during shared book reading (e.g., asking open-ended questions, using stimulating language) is associated with children's language development (Hindman et al. 2014; Huttenlocher et al. 2010; van Kleeck 2003 for similar results).

In accordance with the research findings of previous studies, the BiKS-3-18 study shows that the language and literacy stimulation at home (including activities, interactions and material supposed to stimulate language and literacy measured via questionnaires and observation) is clearly associated with children's *language skills* at the age of 3 years. In the case of vocabulary (Ebert et al. 2013) but not grammar acquisition (Weinert and Ebert 2013), it also accounts for the observed SES-related disparities; i.e. SES-related disparities in children's vocabulary largely disappear when the literacy stimulation in the children's home is included in the model (Ebert et al. 2013; Weinert et al. 2012). However, the differences in language and literacy stimulation at home do not show a general effect on the further *growth* of either vocabulary or grammar between the age of 3 to 5 years. Moreover, no interaction between language and literacy stimulation in preschools and in the families were observed (Ebert et al. 2013; Weinert and Ebert 2013; Weinert et al. 2012). Although simultaneous and time-delayed predictive relationships between language and literacy stimulation and children's language skills are documented in the BiKS-3-18 as well as in other studies, this does not necessarily imply an effect of language and literacy stimulation on children's language *progress*. In this respect, BiKS-3-18 analyses hint to subgroup-specific differences; for example, with regard to vocabulary, an effect of home language and literacy stimulation on the further increase in vocabulary is found in children who were linguistically less advanced at the age of three, but not in linguistically more advanced children (Weinert et al. 2012). Although some studies reveal HLE effects on language growth (e.g. Sénéchal and LeFevre 2014), further literature is not consistent in addressing the question of the relation between the HLE on growth in language development. Many of the longitudinal studies focus on reading development (e.g. Niklas and Schneider 2017), use combined measures (e.g., academic skills, Tamis-LeMonda et al. 2019), or also find no effects of HLE on vocabulary growth (Schmerse et al. 2018).

Overall, it can be assumed that a general home literacy environment measure is too unspecific to show strong language promoting effects. Noteworthy, the various language promoting characteristics assessed within the BiKS-3-18 study are only moderately or not at all associated with each other. This shows that parents who are stimulating in one language facet do not necessarily have to be stimulating in other areas as well (Ebert et al. 2020; Lehrl et al. 2012; see also Attig and Weinert 2020 for similar results with even younger children). The analyses of Lehrl et al. (2012) underline the assumption that different aspects of children's language are fostered by different specific characteristics of the home learning environment which are in turn associated with different aspects of reading literacy in primary school (Lehrl et al. 2013). While the acquisition of letter knowledge proved to be associated with self-reported formal instructions by parents (frequency of learning to read or to teach the alphabet), vocabulary and factual knowledge were associated with the observed quality of stimulating parent-child interactions (e.g. interactive dialogue). With respect to the acquisition of grammar, it is especially the experience with books (e.g. frequency of shared book reading and number of books in household; Lehrl et al. 2012) and the availability of complex sentence structures in observed parent-child interactions that prove to be significant predictors (Anderka 2018). Importantly, the respective facets of language stimulation also accounted for SES-related disparities in the respective language skills thus differing for vocabulary and grammar (Anderka 2018).

With regard to even more specific indicators of the HLE, e.g., the parental mental state language (PMSL; assessed through coding of four vignettes[1]), the BiKS-3-18 study demonstrates that parents' use of mental state language is a crucial element in children's home language and literacy environment. PMSL is

[1] Every scene portrays a moment from daily life (e.g., baking a cake together; looking for lost keys) between a mother and a 4-year-old child, with four potential responses that a parent could make in the situation: two of the options are mental. Within the option including elaborated mental state language, the mother explicitly names a mental state (e.g., surprise and explains or clarifies this mental state while providing more information, e.g., "Dad doesn't know what is inside the box, because he can't see inside the box now that it is all wrapped up. If you tell him, he won't be surprised when he opens it" (Ebert et al. 2020).

notably linked to children's Theory of Mind (ToM) development, even when considering children's language proficiency and other broader aspects of the home language and literacy environment. This relationship is particularly significant for children from lower SES backgrounds (Ebert et al. 2020).

3.2.2 Home Numeracy Stimulation and Mathematical Skills

Activities concerning numbers, shapes, and digits at home have been shown to be associated with children's numerical development (see Lehrl 2018 for an overview). Similar to the home literacy research, formal numeracy activities are associated with basic numerical skills, like counting or digit naming (LeFevre, Fast et al. 2010; LeFevre, Polyzoi et al. 2010; Skwarchuk et al. 2014), and informal numeracy activities are associated with non-symbolic mathematical skills (Skwarchuk et al. 2014). However, the evidence concerning effects on symbolic-mathematical skills is mixed (Niklas and Schneider 2013, for positive, Huntsinger et al. 2016, for negative effects). Moreover, the amount and quality of "math talk" has been shown to be associated with mathematical development (Levine et al. 2010; Ramani et al. 2015). Ramani et al. (2015) for instance found, that advanced math talk (i.e., math talk involving cardinality, ordinal relations, and arithmetic) predicted pre-schoolers' advanced numerical knowledge (e.g., enumeration, cardinality, number line).

Many concepts of measuring mathematical stimulation via questionnaires in the home learning environment emerged after the launch of the BiKS-3-18-study in 2005 (e.g., LeFevre et al. 2009; Skwarchuk et al. 2014). However, as described in Rossbach et al. (this volume), we captured some aspects of mathematical stimulation especially through a semi-standardized interactional book-reading situation. Anders et al. (2012) showed that a global home numeracy indicator, comprising both, frequency of formal numeracy activities, available numerical material and quality of math talk, was not associated with children's growth in mathematical competencies. By disentangling the indicator, Lehrl, Ebert et al. (2020) documented, that the quality of math talk (verbal interaction regarding mathematical content) at the age of three was related to better mathematical competencies at preschool age and beyond (twelve years of age), even after controlling for family background characteristics such as the mother's educational level and the family's SES. The preschool math competencies mediated the predictive effect up to age 12. Formal numeracy activities in contrast showed no effects. These results point to the importance of measuring home numeracy stimulation as differentiated as the home literacy environment.

3.2.3 Cross-Domain Effects of the HLE

Although the above presented results suggest that HLE-effects are domain-specific, there are also some hints to cross-domain effects. However, there are only few studies that investigated both domains of HLE—literacy and numeracy—simultaneously and compared the effects on both developmental domains. In one of these studies, Manolitsis et al. (2013) found that formal literacy activities predicted mathematical skills as good as formal numeracy activities, and other studies showed that home literacy activities might be even better predictors for math skills (Baker 2014; LeFevre, Polyzoi et al. 2010). This could be attributed to the fact that, firstly, there are substantial correlations between domain-specific HLE scales (Lukie et al. 2014; Manolitsis et al. 2013; Skwarchuk et al. 2014) and, secondly, developmental advancements in language, literacy, and numeracy are interconnected, too (LeFevre, Fast et al. 2010; Purpura et al. 2011; Purpura and Reid 2016). One potential mechanism could be that by engaging their children in literacy-related activities at home, parents equip them with the language abilities necessary for the cultivation of mathematical skills (Anders et al. 2012). An alternative mechanism could be that parents who regularly engage in literacy activities with their children introduce mathematical terminology and concepts during those interactions (e.g., counting or discussing spatial relations while engaging in shared reading). Both aspects, namely, the encouragement of literacy and language skills, and the promotion of numeracy, could be indicative of the overall level of parental engagement in educational activities with their children. Consequently, these factors may influence children's development in both literacy and numeracy domains.

Nonetheless, Napoli and Purpura (2018) demonstrated that engagement in home numeracy activities may serve as a more potent predictor of language development compared to home literacy activities. The authors posit that this connection "may be due to the opportunity that parent–child numeracy practices present for in-depth verbal interactions. When parents scaffold their children's numeracy development, they are likely providing explanations to their children that may contribute to their vocabulary development" (p. 596). This aligns with Lehrl's (2018) suggestion that advanced 'math talk' could represent a distinct form of abstract language, a concept that has been established as a predictor of children's language development in numerous research studies (see van Kleeck 2003 for an overview). Investigating such cross-domain effects helps to understand how environmental stimulation enhances children's cognitive development across different domains.

Data of the BiKS-3-18 study allowed to include both domains of stimulation of the HLE in our predictive models on children's competence development. Similar to the afore mentioned studies, Anders et al. (2012) found that a measure of literacy stimulation which comprised formal and informal activities in the home literacy environment predicted numerical skills even better than a measure of math stimulation, which included formal numeracy activities and quality of math talk. Similarly, with respect to the more specific HLE indicators, Lehrl, Ebert et al. (2020) found, that informal literacy stimulation (book exposure) was associated with math competencies, over and above the effect of quality of math talk. At the same time, quality of math talk was associated with language development as well, which strive in with the results of Napoli and Purpura (2018) and hints to the hypotheses provided by the authors.

Moreover, the BiKS-3-18 study documented, that effects of the home literacy environment are not only specific to language and academic domains. The home literacy environment was shown to be directly associated with the development of more cooperative and less aggressive behavior, and indirectly, via early language skills additionally with emotional self-regulation (Rose et al. 2018; see for similar results Foster et al. 2005) and also with enjoyment of learning and persistence (Richter et al. 2018). Shared reading between a caregiver and child might foster social-emotional health through aspects such as social-emotional reciprocity and emotional coregulation (Murray 2014). Parents might use shared reading situations to discuss emotions, rules, and norms based on the stories in books (Landry and Smith 2007; Rose et al. 2018).

4 Effects of Preschool Quality on Children's Development

A large number of studies indicate that high-quality ECEC is beneficial for children's development (Barnett 1998, 2011; Mashburn et al. 2008; Shonkoff et al. 2000). A widely used approach to conceptualize preschool quality is the framework of the Early Childhood Environment Rating System (Revised Edition: ECERS-R; Harms et al. 1998; see in more detail Rossbach et al. this volume). It includes teacher-child interactions, the availability and diversity of materials, and the safety as well as the overall arrangement of the preschool environment. In accordance with this framework the ECERS-R was extended by ECERS-E to measure preschool quality in specific developmental domains such as literacy and mathematics (ECERS-Extended Version, ECERS-E, Sylva et al. 2003). This framework is supported by research that demonstrated that domain-specific stimulation, beyond more general stimulation, is related to specific domains of development, including early math (e.g., Clements and Sarama 2007) and early literacy (e.g., Lonigan et al. 2011). ECERS-R and ECERS-E were implemented within the BiKS-3-18 study. Both scales were administrated by trained observers during one typical morning in preschools (four hours) at each measurement point without implementing structured situations.

4.1 Effects of Language Stimulation in Preschool

With regard to language promotion in preschools, BiKS-3-18 data and analyses confirm and expand national and international findings, which have repeatedly shown that the effects of language promotion in institutional contexts often lag far behind those that would have been expected (Dickinson et al. 2011; Piasta et al. 2012; Roos et al. 2010). In particular, in the BiKS-3-18 study, differences in literacy stimulation in preschools did not show a significant effect on either vocabulary growth (Ebert et al. 2013; Weinert et al. 2012) or grammar acquisition (Weinert and Ebert 2013) over the preschool period. This is surprising at first glance. An explanation (see Weinert and Ebert 2017) may be that (a) the domain-specific qualities of the learning environment in the nearly 100 preschools were not very high on average and thus possibly too low. (b) In addition, the variance between preschools in their literacy stimulation was not very pronounced and thus possibly too limited to produce effects. This would have, however to be true for mathematics as well, but in this domain we find effects. Thus, (c) another explanation may be that the chosen measure of literacy stimulation may have been too unspecific and that the requirements on effective language support may be more demanding than covered by a relatively unspecific global literacy measure. Against this background, more specific measures of language stimulation should be investigated with regard to their effects on the acquisition of vocabulary and grammar (see also Huttenlocher et al. 2002) as well as with respect to their impact on other developmental domains (e.g., Ebert et al. 2020). This idea is supported by the findings of Lehrl and Smidt (2020) using BiKS data. They found positive relations between ECERS-E literacy stimulation and children's letter knowledge at age 5.

4.2 Effects of Mathematical Stimulation in Preschool

In contrast to the absent effects of preschool quality on language development, for the mathematical domain we find clear evidence for short (Anders et al. 2012, 2013) and long-term (Lehrl et al. 2016) effects of the observed math related quality in preschools, which are still evident when controlling for the quality in the primary school, which had an additional effect on class three math fluency (Lehrl et al. 2016). These findings gain importance when considering that research on associations of domain-specific preschool quality in stimulating mathematics with children's mathematical competencies is rare, especially with a focus on concurrent and longitudinal effects. For instance, Sammons et al. (2008) found a total score of academic-oriented preschool quality across the domains language, literacy, mathematics, and science (measured by the ECERS-E total score) to be associated only with mathematical competencies at age 10—cross sectionally—but not with the progress between the ages of 6 and 10 years. Within the BiKS-3-18-study, Anders et al. (2012) and Anders et al. (2013) could show that using a domain-specific approach in measuring preschool quality—quality of stimulation in mathematics (measured by the ECERS-E subscale "mathematics") resulted in increased effect sizes compared to using a more global measure of preschool quality (ECERS-R) in predicting growth of mathematical competencies between age 4 and 6 (measured by the subscale "arithmetics" of the Kaufman Assessment Battery for Children (K-ABC); Melchers and Preuß 1991). Moreover, Anders et al. (2013) also revealed positive relations of this domain-specific preschool quality scale and progress in mathematical competencies from preschool (age 5) through Grade 1 (age 7). When focusing on the further development beyond preschool, Lehrl et al. (2016) found that the domain-specific preschool quality even predicts growth in math fluency (measured by Heidelberger Rechentest (HRT [Heidelberger Calculation Test]; Haffner et al. 2005; subscales adding and subtracting) beyond the preschool years. Preschool quality was significantly associated with gains in math fluency from Grade 1 to Grade 3 even when controlling for initial mathematical competencies at age 3, social background variables, and other early (HLE) and concurrent (primary school quality) learning environments. These findings underscore the importance of examining preschool quality within specific domains, as opposed to confining research solely to general quality indicators, when evaluating its impact on mathematical outcomes.

5 Combined Effects of the Learning Environments

In addition to the independent effects of HLE and preschool quality on several developmental domains, moderated effects through the other early and middle childhood learning environments (family and primary school) as well as individual child characteristics seem to be relevant. When examining the interplay of multiple learning environments on developmental outcomes, four types of relations are possible (Miller et al. 2014): (a) additive effects, i.e., independent effects of the learning environments, (b) compensatory effects, i.e., children with worse quality in one learning environment profit more from high quality in another learning environment, (c) accumulated advantage effects, i.e., children with high quality in one learning environment profit comparatively more from high quality in another learning environment (also known as "Matthew effect", Walberg and Tsai 1983), and (d) accumulated disadvantage effects, i.e., children with low quality in all learning environments show particularly low scores on outcome measures when compared to children with different quality experiences (Watamura et al. 2011).

As reported in the sections above, the early and middle childhood home learning environment has been shown to be of great importance in explaining differences in children's academic outcomes (Anders et al. 2013; Melhuish et al. 2008; Niklas and Schneider 2014; Sammons et al. 2008; Son and Morrison 2010; Zadeh et al. 2010). When examining studies that investigated family background moderators of the effect of preschool quality on children's academic outcomes, Burchinal, Vernon-Feagans et al. (2014) resume, "while some evidence suggests higher child care quality might be more important for low-income/at-risk children than for other children, there is more evidence suggesting that child care quality is a modest predictor of academic and social skills regardless of social class" (p. 42). The limited number of studies that have explored the moderating role of HLE process variables have yielded inconsistent findings. For instance, Sammons et al. (2008) drew on data from the EPPE study and reported that the quality of preschool is crucial for children's mathematical learning progress, particularly when they receive minimal cognitive stimulation at home. Conversely, Tietze et al. (2005) did not discover any interaction effects between early HLE and preschool quality on school achievement at age 8. Similarly, the NICHD-Study found no significant interaction effects between early HLE and preschool quality on children's mathematical outcomes at age 4.5 (NICHD ECCRN 2004). Moreover, Burchinal, Lowe Vandell et al. (2014), using data from the NICHD-dataset, found that the connections between childcare quality and academic-cognitive skills at age 15 are influenced by the HLE, particularly maternal sensitivity during adolescence (age 15), but not by the HLE during early or middle childhood. As a result, while some studies support the idea of the accumulated advantage hypothesis, others lend support to the compensatory and additive hypotheses. When assessing the predictive role of the early HLE, it's crucial to consider subsequent HLE to eliminate the possibility that it's the concurrent learning environment, rather than the early one, that predicts child outcomes, as noted in studies by Anders et al. (2013), Downer and Pianta (2006), and Toth et al. (2020).

With regard to the BiKS-3-18 study, Anders et al. (2012) found higher gains in mathematical skills during preschool with increasing preschool quality especially for children with medium or high-quality early home learning environments. This outcome indicates that the impacts of the two learning environments, do not merely add up together. Children with a moderately or highly favorable HLE appear to benefit from a high-quality preschool, while those with a less favorable HLE do not appear to gain from two years of high-quality preschool enrichment. This pattern of findings aligns with the notion that educational experiences at preschool must receive sufficient support at home to yield their full effects. Similarly, Lehrl et al. (2016), who investigated the growth of arithmetic competencies between Grade 1 and 3, observed a moderating effect of middle childhood HLE on preschool quality. Specifically, higher preschool quality was linked to greater initial math skills in Grade 1, but only when middle childhood HLE was of high quality. In simpler terms, preschool quality significantly impacts math skills related to addition and subtraction in Grade 1, but this effect is realized only when it's coupled with a high-quality middle childhood HLE. It seems, that the children from high quality early HLE's profit most from high preschool quality (Anders et al. 2012; Pinto et al. 2013) and that this association is carried forward to the initial state at Grade 1. This pattern of findings also suggests that the initial advantages experienced by children from high HLE households who attended high-quality preschools persist when they enter school, as there is no indication of catching up effects. These findings seem to be particularly relevant with regard to cooperation practices between family and preschool. Findings from other studies suggest that specific cooperation measures are related to the children's competence growth via the enrichment of the HLE (Lehrl, Floeter et al. 2020).

An important concern with regard to interaction effects is, that preschool quality effects might fade away in the long run when those children attending high quality preschools go on to attend primary schools with low instructional quality (Barnett 1998). In the absence of high instructional quality at primary school, the superior academic skills of preschooler's who attended high-quality preschools might not progress and their initial advantages may be lost (Crosnoe et al. 2010; Watamura et al. 2011; Woodhead 1988; Zigler and Styfco 1994). Based on this hypothesis, the impact of preschool quality on children's outcomes may only endure until the end of primary education, particularly if those who experienced high-quality preschool education also continue to receive a high level of instructional quality in primary school.

Within the BiKS study, Anders et al. (2013) also analyzed interaction effects of preschool quality and instructional quality in primary school on mathematical skills at age 7 and found no interaction effect. Similarly, Lehrl et al. (2016) found no interaction effects between preschool and primary school quality, suggesting additive effects of the two learning environments, as further results showed positive effects of primary school quality on arithmetic (Lehrl et al. 2016) and vocabulary development in primary school (Grosse et al. 2017).

Data from the BiKS study allows for more in-depth analysis than those reported. For example, Schmerse (2021) found that Dual-Language Learners (DLLs) showed improved language skills at a faster rate when their peers had higher abilities in the majority language, compared to DLLs in classrooms where peers had lower skills. In another paper he reported positive effects of a specific ECERS-R interaction scale on children's task persistence and a moderated mediation, where the quality effects on children's persistence, and indirectly on 2nd graders achievement were stronger for low SES children (Schmerse 2020). Moreover, Oppermann et al. (2023) showed a moderation of child's gender concerning the association between preschool quality and children's socio-emotional outcomes at 2nd grade.

6 Conclusion

This chapter presented results of the short and long-term effects of the home learning environment and preschool quality on different aspects of child development, mainly in the domains of language and mathematics. In the last about 20 years high expectations on the gains of investments in fostering early learning in the home and in preschools have been established. In general, national and international research support such expectations. However, the results are not always consistent and research deficits exist with regard to domain-specific early stimulation at home and in preschools—this is especially true for Germany. The data of the BiKS-3-18-study build a rich source for following differentiated research questions and represents one of the very few German longitudinal studies in this area.

The BiKS-3-18 study has differentiated between formal (i.e. explicit teaching) and informal (i.e. integrated in play) stimulation especially in the domains of language and mathematics. Results show, for example, that literacy stimulation at home is associated with language skills at the age of 3 years but not with language progress (vocabulary and grammar) over the preschool years. However, we find subgroup-specific differences related to developmental status. While language stimulation at home impacts on vocabulary growth in children who were linguistically less advanced at age three this was not the case in more linguistically advanced children. This might indicate that language promoting factors in the learning environment differ across development. Further research should expand such attention to subgroup-specific effects for children with different early developmental starting points. In addition, not only general home literacy measures should further be considered since we find that parents who show stimulating behavior with respect to one language facet need not do so likewise with respect to others and that different facets of child language are fostered by different characteristics of the home learning environment. Overall and in accordance with the Specificity Principle of child development (Bornstein 2017), we found specific characteristics of the learning environment to stimulate specific facets of children's language development (vocabulary, grammar, literacy) at specific timepoints in development.

For stimulation of mathematics at home, we find that the quality of math talk at the age of three predicts better mathematical competencies at preschool age and beyond (twelve years of age). Yet, formal numeracy activities showed no effects. Therefore, research is advised to consider differentiated aspects both on the side of home stimulation and on the side of developmental domains. Further results show cross-domain effects of stimulation in certain domains at home. For example, we find that informal literacy stimulation (book exposure) is associated with math competencies over and above the quality of math talk and that the home literacy stimulation is directly (as well as indirectly via child language) associated with the development of more cooperative and less aggressive behavior and indirectly via child language with the development of children's emotional self-regulation. An important message for further research is therefore to put more emphasis on such cross-domain effects (see also Weinert and Ebert this volume).

For language stimulation at preschool, we did not find an effect on language growth or grammar acquisition. We discussed above several possible explanations. One should be mentioned here again: The quality of language stimulation in preschool was not very high; thus, at best medium level of quality may hinder visible effects on children's language development. Yet, although the quality of stimulation of mathematics was even lower, clear evidence occurred that the quality of math stimulation is related to growth of math competencies during preschool and beyond at least till Grade 3 in primary school. Similar effects could not be found for the global quality of stimulation in preschool. Since research on the effects of stimulation in mathematics in preschool is still rare, we need more studies on these relations. In addition, we need studies with a higher quality (and variance) of stimulation in preschools in both domains language and mathematics using more refined measurement instruments for serval domains of stimulation.

The relations between quality of the learning environment at home and at preschool is—at least conceptually—controversial with the hope that a high quality of stimulation in preschool may compensate for low quality at home. Overall, research results are inconsistent, and, in the BiKS-3-18 study, we did not find compensatory effect. Rather, our results show higher gains in mathematical skills during preschool being associated with comparatively higher preschool quality for children with medium or high quality of the early home learning environment, i.e., a Matthew effect and not a compensatory effect (see similar results for reading development on the individual child level, Kuger and Lehrl 2013). We draw at least two conclusions. First, this result was found at a rather low preschool quality level and may be different for a high-quality level. Second, not only stimulation at preschools should be considered but also family programs which help to increase the home learning environment especially for children from disadvantaged families, including strengthening parent-preschool partnerships. One last important result should be emphasized. The BiKS-3-18 study finds no interaction effect between preschool and primary school quality on mathematical skills. That is, the effects of these environments are independent from each other. Thus, independently of the afore attended preschool, instructional quality at primary school is important for further mathematical development. These findings underline the importance of high interaction and instructional quality across all learning environments.

Finally, yet importantly, a replication of the BiKS-3-18 study is desirable. Since preschool participation for children under 3 years of age has enormously enlarged since the BiKS-3-18 study started, such a replication should start with even younger children. Although the Newborn Cohort Study of the German National Educational Panel Study (Attig et al. 2019) gives valuable insights into the very early developments (see, e.g., Attig and Weinert 2020; Weinert et al. 2016) it cannot replace such a study because the design of the National Educational Panel Study does not allow such intensive investigations of the interactions between qualities of the early home and preschool environments.

Further analyses of the BiKS-3-18 data will show whether there are even longer lasting effects of early childhood education at home, and in preschools on cognitive and so-called non-cognitive skills and how they might be mediated or moderated by children's development.

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Transitions to Primary School: School Entry Decisions, Parents' and Teachers' Ideas About School Readiness, and Cooperation Between Preschools, Primary Schools, and Parents

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Abstract

In the present project of the BiKS-3-18 *'Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age'* longitudinal study, quantitative and qualitative methods were used to study the transition from preschool settings to primary school. The focus was on the ideas about school readiness among parents, preschool teachers, and primary school teachers, on parents' school entry decisions, and on cooperation between preschools and primary schools. The results show that parents, preschool teachers, and primary school teachers have similar ideas about school readiness, with some variance between the groups of respondents regarding the importance of the various criteria. Parents' school entry

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decisions are based on criteria that vary in prominence depending on the time of school entry. Moreover, parents with a migration background tend to oppose delayed school entry. Furthermore, the results show that children enrolled early have lower skills than their classmates in the first year of school. Children enrolled late are consistently considered to have better skills than their classmates. Most parents are satisfied with their school entry decision. Cooperation between preschools and primary schools mainly takes place at a low level.

Keywords

Transition · Preschool · Primary school · School enrolment · School readiness · Cooperation

1 Introduction

Entering compulsory schooling represents a critical juncture in children's educational biographies. For decades, the transition from preschool settings to the formal school environment has raised different issues, which have been studied from different disciplinary perspectives. From a pedagogical perspective, the possibilities of bridging the gap between these two areas are discussed in terms of structure and curricula as well as the possibilities of (re-)designing the transition and the school entry phase. From a sociological perspective, the transition is analysed as a selection threshold at which social inequalities become visible. Studies grounded in educational psychology have focused on children's individual adaptation efforts when coping with the transition.

The primary school education project of the BiKS-3-18 '*Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age*' longitudinal study looked at the transition from preschool settings to primary school from multiple perspectives. One focus was on analysing parental decisions to enrol their child in school at the standard school starting age or a year early or late. The goal was to identify the criteria that parents use when making school entry decisions and what this process and its outcomes look like for parents who enrol their children early or late, as well as for parents with a Turkish migration background. In this context, we also studied the ideas of school readiness among those involved in the transition, as well as collaborative activities between preschools and primary schools to help bridging the gap between these two areas.

2 Theoretical Foundations on School Entry

To date, there is no comprehensive theory of school entry. Theoretical approaches so far have been based on different paradigms, each describing the transition process from a different perspective (Pohlmann-Rother and Then 2023).

Models of *education economics* focus on economic aspects of educational processes, institutions, and systems: it is questioned how (financial, personal, etc.) resources can be distributed and invested most efficiently in the education system (Weiß 2012). With respect to school entry, the 'optimal' age for starting school is of particular interest, whereas the behaviour of the stakeholders involved in the transition (e.g., children, parents) is neglected. Therefore, approaches of educational economics are not sufficient to systematize the transition to school in all its facets.

Another understanding of educational transitions can be derived from *theories of stress*, e.g., the transactional theory of stress offered by Lazarus (1966). According to Lazarus (1966), individuals perceive changes in their lives (e.g., transition to school) as stressful events if they think their individual resources are not sufficient to cope with these changes. Therefore, theories of stress focus on the individual's competences to cope with the transition process and changes in its context.

Following *eco-systemic models*, successful educational transitions depend on the adequate interactions between the ecosystems involved in the transition (Rimm-Kaufman and Pianta 2000). The model by Bronfenbrenner (1979) served as the basis for the development of what is currently the most influential theory of transition in the German educational context: the IFP transition approach ("Transitionsansatz") by Griebel and Niesel (2004). In this model, transitions are understood as co-constructive processes that require the cooperation of all actors involved to be successful. The guiding assumption is that transitions in people's educational biographies are accompanied by developmental tasks at different levels (Griebel and Niesel 2004). However, as a theoretical framework to explain the transition to school, the IFP transition approach needs additional qualification. First, it takes insufficient account of the special features that characterize the transition to primary school. Second, the transition model assumes school entry to be a crisis event for children—an assumption that lacks sufficient empirical support (Beelmann 2006; Kluczniok et al. 2015). These limitations notwithstanding, the eco-systemic model does provide valuable input for developing a systematic theory of school entry by conceiving of the transition as a process involving actors from all relevant ecosystems.

Furthermore, transitions may be described from the perspective of *general transition research*. In this perspective, transitions in the educational system are studied against the background of an individual's entire life span (Tillmann 2013), taking account of both the general structural conditions governing the transition and the subjective processing of the persons involved in the transition. The eco-systemic perspective is integrated by looking at the interplay of the various ecosystems (Faust 2013). Based on these theoretical concepts, general transition research offers a comprehensive approach to analysing educational transitions that considers both the systemic and the biographical level. In doing so, general transition research provides a very broad approach to systematize transitions. Therefore, a specification is necessary if general transition research is used to conceptualize school entry process.

3 State of Research

3.1 School Readiness: Theoretical Concept and Parents', Preschool Teachers', and Primary School Teachers' Subjective Perspectives

Entry into the formal school system in Germany is framed by specific institutional requirements. Aside from age, the educational policy discourse of the past decades has identified school readiness as a key criterion for school entry. That concept has also been incorporated in school law (Plehn 2018). In the legal provisions, school readiness is primarily linked to the child's physical, cognitive, and socio-emotional development and can still be found in this form in the majority of state laws today.

In scientific discourse, the concept of school readiness has undergone significant changes over the last century. Maturationist views focusing on children's innate abilities and theories based on child characteristics were succeeded by a conceptualization of school readiness from an eco-systemic perspective (Nickel 1981). Building on the eco-systemic view of educationally relevant transitions, school readiness in this conceptualization is understood as a target dimension that can only be reached if all those involved in the school entry process work together (Kammermeyer 2014). This means that what characterizes school readiness in the eyes of those providing guidance and making decisions with respect to school entry (i.e., parents, preschool teachers, and primary school teachers) is critically important. Hence, in the research on school readiness, the subjective perspectives of parents and pedagogues are of high interest.

Recent studies indicate that parents (Ring et al. 2016) as well as preschool teachers (Niklas et al. 2018) and teachers in school-based settings (Hustedt et al. 2018) identify *socio-emotional skills* as an important, sometimes even the most important, criterion to determine school readiness. In addition, a child's *linguistic development* is considered critically important by parents (Wesley and Buysee 2003), preschool teachers (Flender 2009), and primary school teachers (Kammermeyer 2000). Likewise, *cognitive skills* play a key role in school readiness according to parents (Altun 2018), preschool teachers (Niklas et al. 2018), and primary school teachers (Kammermeyer 2000). Unlike these child-related criteria, *characteristics of the ecosystem* (e.g., the family environment) are considered less important with respect to a child's school readiness in the majority of studies (for an exception, see Flender 2009).

Differences in the school readiness concepts of parents, preschool teachers, and primary school teachers emerge primarily in how the school readiness criteria are weighted. *Cognitive skills* as school readiness criteria, for example, tends to be considered less important by preschool teachers and more important by parents (Piotrkowski et al. 2000). *Pre-academic skills* (e.g., basic spelling skills) tends to be considered less important by primary school teachers and more important by preschool teachers (Abry et al. 2015) and parents (Piotrkowski et al. 2000).

3.2 Parental Decisions on School Entry

When it comes to school entry, parents have to decide whether or not to enrol their child in school at the standard school starting age. This means that children either start school by the time they reach the compulsory schooling age or they start school although they have not yet reached school age (early school entry) or have already passed it (delayed school entry) (Plehn 2018). The children of immigrants are a group that is often disadvantaged in the school entry process, for instance through high rates of delayed school entry (Kratzmann and Schneider 2009). The following analysis will therefore focus not only on the two non-standard school entry variants but also on the school entry of children with a migration background.

As the formation of parental decisions is not an explicit focus of pedagogic transition theories, additional theoretical approaches are needed to describe parental decision making in the context of school entry. For this purpose, models grounded in Expectation-Value-Theories (e.g., Eccles 1983) are widely referred. According to these theories, parental decisions for early or delayed school enrolment depend on the value the parents assign to (early or delayed) enrolment as well as their expectations how their child will succeed in school because of the (early or delayed) school starting point (Faust 2013). The assigned value results from the calculation of costs and benefits the parents associate with the early or delayed enrolment.

3.3 Early School Entry

Currently, 2.7% of all school enrolments in Germany are early enrolments (Autorengruppe Bildungsberichterstattung 2022), with especially strong rates among children from academic backgrounds (Kratzmann and Schneider 2009) and girls (Autorengruppe Bildungsberichterstattung 2022). The study by Tietze (1973) provides information on the decision-making criteria that parents use when deciding whether to enrol their child early. The study shows that parents in favour of early school enrolment cite early academic support for their child as an important reason. Parents who argue against early school enrolment explain, among other things, that they do not want to reduce their child's playtime in its preschool setting. They view school as stressful for their child and free play in preschool as an important context for personal growth. Recent studies show that this distinction between school as a demanding institution and preschool as a 'place of good childhood' is still sometimes found in parental attitudes (Andresen et al. 2013). On the one hand, studies focussing on the effects of early school enrolment find that, within a school entry cohort, children enrolled early are more likely to repeat a year than children enrolled at the standard age (Bellenberg 1999). On the other hand, studies on the competence development of children enrolled early show that they tend to be equal or superior to their older peers (Gold et al. 2012). In addition, children who start school early often receive a recommendation to attend a university-preparatory high school (Gymnasium) at the end of primary school (Fina 2017) and are more likely to attend a higher-level secondary school type than children enrolled late, for example (Seyda 2009).

3.4 Delayed School Entry

Currently, 6.6% of all school enrolments in Germany are delayed enrolments (Autorengruppe Bildungsberichterstattung 2022). Children of low social status or from non-academic backgrounds (Liebers 2011), boys (Autorengruppe Bildungsberichterstattung 2022), and children of immigrants (Tuppat et al. 2016) are especially likely to start school late. Donath et al. (2010) find that the main reasons for parents who prefer delayed enrolment include, aside from their child's date of birth, the desire to strengthen their child's self-confidence and to protect their child from problems arising from school-based learning. Likewise, Liebers (2011) finds that parents tend to name child-related aspects such as a lack of skills (primarily cognitive and linguistic skills) as the most important reasons for enrolling their child late. Studies focussing on the effects of deferred school entry offer a divided picture. Despite the delay in their educational biography, children enrolled late tend not to experience disadvantages in their competence development compared to children enrolled at the standard age (Hong and Raudenbush 2005; Jaekel et al. 2015). The rate of children repeating a year is about the same among those enrolled late and those enrolled at the standard age and even lower than among children enrolled early (Bellenberg 1999), but it is reasonable to attribute this not so much to their superior academic performance but rather to their advanced age, which may keep teachers from further delaying their school career by requiring them to repeat a year. However, delayed school entry does seem to have positive effects on the children's socio-emotional development (Hong and Yu 2008).

3.5 School Entry of Children with a Migration Background

The rate of delayed school entry is twice as high among children with a migration background as among children without a migration background (Kratzmann and Schneider 2009; Tuppat et al. 2016). This is particularly true for children with a Turkish migrant background. To explain this phenomenon, previous research has pointed out individual and institutional reasons. At the individual level, the lower linguistic skills of immigrant children are seen as the most important reason (Schöler et al. 2004). In addition, some Turkish parents see delayed school entry as an opportunity to better prepare their children for their first year in school (Rachner and Unger 1994). Reasons *against* delayed school entry, on the other hand, are found in parents' general ideas about education. An upbringing based on authority and reproduction, as frequently found in Turkish immigrant families, might be in conflict with German early childhood education and care, which is characterized by self-determination (Jäkel and Leyendecker 2009).

At the institutional level, the school system is considered to contribute to migration-based inequalities in school entry. In that line of thinking, immigrants are already disadvantaged in the German education system because of the lack of recognition for their original language and culture (Gomolla and Radtke 2009). According to the argument of institutional discrimination (Gomolla and Radtke 2009), immigrant children are more likely to start school late or be transferred to remedial classes than non-immigrant children because schools want to preserve the (presumed) homogeneity of achievement in primary school classrooms. Moreover, there is a possibility for immigrant children to experience prejudice and stereotyping from primary school teachers and preschool teachers, resulting in an unfair assessment of their performance (Alexander and Schofield 2008). In addition, their exposure to stereotypes about their social group may cause immigrant children to experience lower levels of self-confidence and motivation compared to non-immigrant children, regardless of whether they actually subscribe to the stereotype—a phenomenon known as 'stereotype threat' (Steele and Aronson 1995).

3.6 Cooperation of Preschools and Primary Schools

The question of how to bridge the gap between the two educational settings of preschool and primary school is among the most heavily discussed issues in the context of school entry. Cooperation between the institutions is repeatedly emphasized as the most suitable measure to ensure seamless educational biographies. In German education policy, this trend has led to the adoption of a 'Common Framework for Early Education in Preschool Settings' ('Gemeinsamer Rahmen für die frühe Bildung in Kindertageseinrichtungen') (Meyer-Siever 2015, pp. 21 f.). The need for cooperation is also stated in most of the 16 federal states' curricula, educational plans, and school codes.

The most widely used model for categorizing different types of cooperation is the model by Gräsel et al. (2006), which distinguishes three levels of cooperation: exchange, division of work, and co-construction. Exchange is the least intensive level, and studies have shown that this type of cooperation is most common in the transition to school. For example, giving preschool children the opportunity to visit a primary school is the most frequent collaborative activity in Germany (Hanke et al. 2013; Meyer-Siever 2015). Classroom visits by preschool children are also a common transition practice in the international context (Choy and Karuppiah 2016; Cook and Coley 2017). Collaborative activities that are at the level of co-construction and thus constitute more intensive collaborative relationships (e.g., the joint implementation of observation and diagnostic procedures by preschool teachers and primary school teachers) are realized less frequently (Hanke et al. 2013). Yet it is these intensive forms of cooperation that have an influence on how children manage the transition, whereas measures that merely aim to familiarize the children to the changed living environment at school are less relevant (Ahtola et al. 2011; LoCasale-Crouch et al. 2008).

4 Goals and Research Questions

The present project of the BiKS-3-18 longitudinal study (principal investigator: Gabriele Faust) was linked to the research strands outlined above. Our research interest was focused on the effects of the general structural conditions of school entry on the school enrolment process and on the attitudes of the actors involved in that process. This resulted in different questions, which were investigated in four sub-studies.

1) *Actors' ideas of school readiness:* In this sub-study, we analysed the school readiness criteria that parents, preschool teachers, and primary school teachers believe to be important. The actors involved were interviewed about their ideas of school readiness, their reasons for choosing these criteria, and the relevance they assign to each criterion.
2) *Formation of parental school entry decisions:* In this topic area, we analysed parents' decision-making processes with regard to early or delayed school entry and with regard to the school entry of children with a migration background. The focus was on the formation of parental school entry decisions and on the criteria parents use to make these decisions.
3) *Outcomes of school entry decisions:* In this sub-study, we looked at whether the school entry decisions have proven successful over time. For this purpose, we collected information on children's competence development up to second grade and measured parent's degree of satisfaction with their school entry decision.
4) *Cooperation between preschools and primary schools:* This sub-study focused on the types and frequency of cooperation practices. In this context, we also analysed the attitudes of preschool teachers and primary school teachers towards cooperation, the factors that influence their cooperation, and the effects of various cooperative practices on how children manage the transition.

5 Method

In this project, we used both quantitative and qualitative research methods. To combine both strands of research, the project was set up in a 'concurrent mixed method' design (Tashakkori and Teddlie 2003). Accordingly, quantitative and qualitative research data were first collected separately in order to subsequently integrate the interim results from both surveys into the respective other research strand (Faust et al. 2013, pp. 33 ff.).

5.1 Sample

In the initial sample of the 'BiKS-3-18' study (547 families), 21 children were enrolled early and 24 children were enrolled late. The extended sample, which included the classmates of the original BiKS-3-18 children, comprised (without drop-outs: 992 families) 61 early and 63 late enrolments. For 149 children, the time of enrolment could no longer be determined. Of the parents of the children from the extended sample, 17 per cent had no or low educational qualifications at the time of their children's enrolment (September 2008), 32 per cent had medium educational qualifications, and 49 per cent had high educational qualifications. 2 per cent of the sample provided no information about their educational qualification. Table 1 offers an overview of structural, family-, and child-related characteristics and their distribution in the extended total sample.[1]

Aside from the children, the educational professionals interviewed for this study formed separate sample pools. The total sample of preschool teachers consisted of 97 individuals; the total primary school teacher sample consisted of 142 individuals from 87 primary schools.

Different sample sizes were implemented in the sub-studies. Whereas the quantitative sub-studies aimed at interviewing the total sample, the qualitative sub-studies were limited to sub-samples. Two qualitative interview studies focused on non-immigrant parents for whom early (N = 23) or late enrolment (N = 20) was an option. For the sub-sample of children enrolled early, we selected children from the total sample who had reached the age of six no later than two months after enrolment and showed medium- or high-level skills compared to children of the same age. For the sub-sample of children enrolled late, we selected children from the total sample who had reached the age of six no later than two months before the cut-off date and showed low- or medium-level skills compared to children of the same age. We randomly drew children from both groups; their parents then formed the samples for the interview studies. A

[1] Differences in the sample size are caused by missing values in single structural, family-, and child-related characteristics.

Table 1 Description of the extended total sample (excluding reception classes) by structural, family-, and child-related characteristics

		Early entry	Standard entry	Delayed entry	N_{Total}
German state	Bavaria	30 (4.7%)	552 (87.2%)	51 (8.1%)	633
	Hesse	31 (10.5%)	252 (85.4%)	12 (4.1%)	295
Sex	Female	38 (7.9%)	421 (87.7%)	21 (4.4%)	480
	Male	23 (5.1%)	382 (85.5%)	42 (9.4%)	447
Parental educational qualification[a]	No/low educational qualification	1 (0.6%)	134 (86.5%)	20 (12.9%)	155
	Medium educational qualification	11 (3.7%)	261 (88.8%)	22 (7.5%)	294
	High educational qualification	48 (10.6%)	389 (85.7%)	17 (3.7%)	454
Migration background[b]	No migration background	44 (6.0%)	637 (87.4%)	48 (6.6%)	729
	One parent with migration background	11 (12.1%)	77 (84.6%)	3 (3.3%)	91
	Both parents with migration background	6 (5.7%)	87 (82.9%)	12 (11.4%)	105
Total		61 (6.6%)	804 (86.6%)	63 (6.8%)	928[c]

[a] Educational qualification was operationalised by parents' secondary school attainment
[b] Migration background was operationalised by parents' first language
[c] The difference to the total sample (N = 992) is caused by missing values in parent interviews

third interview study focused on parents of Turkish-speaking origin (N = 25), operationalised by parents' first language. In this study, all parents with a Turkish migration background who had agreed to be interviewed were taken into account (Faust et al. 2013, pp. 35 ff.). Table 2 shows the structural, family-, and child-related characteristics of the subsamples.

Table 2 Description of the samples of the qualitative sub-studies by structural, family-, and child-related characteristics (first survey date)

		Sub-study 'Early school entry'	Sub-study 'Delayed school entry'	Sub-study 'Parents with a migration background'
German state	Bavaria	10 (43.5%)	15 (75.0%)	13 (52.0%)
	Hesse	13 (56.5%)	5 (25.0%)	12 (48.0%)
Sex	Female	14 (60.9%)	6 (30.0%)	11 (44.0%)
	Male	9 (39.1%)	14 (70.0%)	14 (56.0%)
Parental educational qualification[a]	No/low educational qualification	4 (17.4%)	4 (20.0%)	10 (40.0%)
	Medium educational qualification	5 (21.7%)	7 (35.0%)	7 (28.0%)
	High educational qualification	14 (60.9%)	9 (45.0%)	8 (32.0%)
Migration background[b]	No migration background	23 (100%)	20 (100%)	–
	One parent with migration background	–	–	3 (12.0%)
	Both parents with migration background	–	–	22 (88.0%)
Total		23 (100%)	20 (100%)	25 (100%)

[a] Educational qualification was operationalised by parents' secondary school attainment
[b] Migration background was operationalised by parents' first language

5.2 Data Collection and Analysis

The *quantitative surveys* took place every six months from September 2005 (Faust et al. 2013, p. 41). The actors' ideas of school readiness were collected using questionnaires developed on the basis of Kammermeyer (2000) and supplemented with findings from qualitative interview studies (see Pohlmann-Rother et al. 2011, for a detailed description).

In the quantitative surveys on school entry decisions, we used scales from the BiKS-3-18 parent surveys, which addressed family stimulation processes, structural characteristics, subjective attitudes, and child-related ability assessments (Kluczniok 2012, p. 94). The surveys on the enrolment decisions of parents with a Turkish migration background focused on parents' educational aspirations, their attitudes towards academic support, and their level of information, as well as their enrolment decisions and the outcomes of these decisions (Kratzmann 2011, p. 95 ff.). The extent to which school entry involves psycho-social stress for children was measured using a shortened version of the 'child behaviour checklist' (Döpfner et al. 1998).

The outcomes of the school entry decisions were measured through the children's linguistic-cognitive and social-emotional competencies, as well as their volitional characteristics based on the questionnaire for measuring the emotional and social school experiences of primary school children in the third and fourth grades (Rauer and Schuck 2003). As a second measure of outcomes, we used parents' level of satisfaction with their school entry decision, collected in telephone interviews at the end of each primary school year.

The frequency and perceived importance of cooperation was measured through questionnaires using scales on cooperation-related statements and activities based on Huppertz and Rumpf (1983).[2]

The quantitative data material was analysed by computing correlations and performing regression analyses and tests for group differences, as well as latent change models and latent growth models (Faust et al. 2013, p. 46).

In the *qualitative surveys*, parents were interviewed at three measurement points in problem-centred guided interviews. The interviews on the first survey date, conducted one or two years prior to school enrolment, focussed on parents' tentative preference for standard or non-standard school entry and the reasons for that preference, parent's level of information about school enrolment, and parents' understanding of school readiness (Faust et al. 2013, p. 45). The surveys of parents with a Turkish migration background additionally included questions on parental educational aspirations, child-related ability assessments, expectations of the education system, and parents' attitudes towards academic support (Kratzmann 2011, pp. 90 f.). At the second measuring point, three or fifteen months prior to school enrolment, the survey focussed on the decision-making process,

[2] For reasons of space, a detailed description of the scales used in the questionnaire cannot be provided here. Please refer to the research cited.

the role of authorities offering information and guidance on school entry, parents' assessment of their child's preschool, and their expectations of the school. At the third measuring point, three months after school entry, interviewers asked parents about their child's first few weeks at school and their degree of satisfaction with their school entry decision. The interviews were analysed in a deductive and inductive manner using summarising and structuring and, in some cases, also scaling content analysis methods (Mayring 2003).

6 Key Findings

6.1 Ideas About School Readiness Among the Actors Involved in the Transition

Parents, preschool teachers, and primary school teachers agree that a child's ability to concentrate and their social behaviour are key school readiness criteria. All three groups of respondents also assign great importance to cognitive development, as well as to the child's interest in learning and their linguistic development (Pohlmann and Kratzmann 2008; Pohlmann-Rother and Plehn 2010). Prior knowledge of numbers and letters as a pre-academic skill, in contrast, is considered less important by respondents (Pohlmann-Rother et al. 2011).

Whereas the ability to concentrate is unanimously named as the most important criterion, respondents differ in their weighting of the other criteria. Teachers believe that, for children starting school, social skills and an interest in learning are the second and third most important criteria. For parents and preschool teachers, in contrast, the child's independence and its level of intellectual and cognitive development are more important. Parents think intellectual development is more relevant, whereas preschool teachers give more weight to independence. In addition, primary school teachers and preschool teachers attribute even less importance to knowledge of numbers and letters than parents (Pohlmann-Rother et al. 2011).

6.2 Parents' School Entry Decisions

6.2.1 Early School Entry

The descriptive data of the BiKS-3-18 sample show that, in accordance with the findings of the education statistics presented in Sect. 3.2, girls more often started school early than boys, Hessian children more often than Bavarian children, and children from households with high levels of parental education more often than children from households with a low level of parental education (cf. Table 1).

To be able to make statements about relevant decision-making criteria and their role in the decision-making process, Kluczniok (2012) performed a quantitative study to examine the aspects in which parents who enrol their child in school early differ from parents who do not. It became clear that parents who enrol their child early hold higher expectations for their children's academic achievement, have a more positive idea of school, and are better informed about school enrolment legislation. What matters most for parents preferring early school entry are child-related reasons (e.g. when the child is bored in preschool). Cost-benefit calculations and specific opportunity structures (e.g., the child should go to primary school with friends) play a subordinate role. The qualitative results deepen and complement these findings. For example, it becomes clear that parents who enrol their child early also justify their preference with the fact that their child was born close to the cut-off date. Other decision-making criteria include the child's desire and interest in school. The advice and assessment of the child's abilities provided by preschool teachers are another influential decision-making criterion (Faust et al. 2007; Pohlmann et al. 2009).

6.2.2 Delayed School Entry

In the BiKS-3-18 sample, boys were more often enrolled late than girls, Bavarian children more often than Hessian children, and children of parents with low educational qualifications more often than children of parents with high educational qualifications (cf. Table 1).

The criteria that parents use when deciding to delay school enrolment are revealed in a recent qualitative study by Wehner (2015). Parents who prefer delayed enrolment cite age as a main criterion, arguing that their child is 'too young' for school entry. When deciding whether their child is ready for school, parents consider the child's general level of development and its interest in school. In general, parents who enrol their child in school late tend to adopt a deficit-based perspective towards their child, which focuses on the child's developmental deficits (e.g., in social skills). This view is accompanied by an idea of school that is strongly narrowed to the aspect of academic achievement, which is prevalent among parents who delay their child's school enrolment. Finally, the institutional conditions, such as the recommendations by preschool teachers, also have an influence on the school entry decision.

6.2.3 School Entry Decisions of Parents with a Turkish Migration Background

Whereas the rates of early and late enrolment were similar among children without a migration background in the BiKS-3-18 sample, children with a one-sided migration background (i.e., with one parent speaking a non-German first language) more often started school early rather than late. Among children with a migration background on both sides of the family, on the other hand, delayed enrolment occurred more often than early enrolment (see Table 1).

The criteria that parents with a Turkish migration background use when deciding when to enrol their children in school were examined in the study by Kratzmann (2011). The results show that child-related decision-making aspects, such as the child's age and skills (e.g., German language skills) are among the most influential criteria. Parents with a Turkish migration background tend to oppose deferred school entry, because it is often seen as a social stigma. One reason for parents with a Turkish migrant background to send their children to school earlier or not to delay enrolment is the fact that German public primary schools do not charge fees. The thought that their child could start school with their friends or siblings also plays a role for parents with a Turkish migration background, as does the desire to find the best possible place for their child to receive support. In addition, Turkish immigrant parents are often dissatisfied with the pre-school support their child received in early childhood settings. Therefore, one reason why standard enrolment is sometimes preferred is that parents hope their child will find a more adequate supportive environment at primary school.

Education-related motives are also important for parents with a Turkish migration background when making their school entry decisions. Preferences for early school enrolment are primarily based on a child's higher learning ability in early childhood and pragmatic motives such as the thought that children enrolled early will also complete their school career earlier. Almost all parents with a Turkish migration background express concern that educational opportunities for their children may be limited because of their migration background. Their own bilingualism is a main concern here, leading to a desire for German language support in preschools.

6.3 Outcomes of School Entry Decisions

To analyse the outcomes of the school entry decisions, we looked at two criteria: the development of a child's skills from the last year of preschool to the second year of primary school and parents' satisfaction with their decision over the first two years of school attendance.

When comparing children in the same year, the academic *skills of children enrolled early* are initially lower than those of their classmates who were enrolled at the standard age. This applies to both mathematical and linguistic skills. However, by the time they reach second grade, systematic differences are no longer found between children who started school early and those who started school at the standard age. In contrast, a comparison of children of the same age shows that those enrolled early achieve on average higher scores in numeracy through the first school year than their peers at the same time in their last year of preschool. These advantages also persist in the two subsequent years. With respect to linguistics skills, hardly any differences are found (Kratzmann et al. 2013).

The *skills of children enrolled late* are on average higher in the first year than those of children who were enrolled at the standard age. With regard to mathematical skills and passive vocabulary, this effect continues and becomes even stronger in the second year. When comparing children of the same age, children enrolled late achieve on average lower scores in mathematics and listening comprehension through their last year of preschool than their peers through their first year in primary school. No differences are found with regard to passive vocabulary, however (Kratzmann et al. 2013).

Our findings on children's psychosocial stress do not suggest that children experience a *school entry crisis*. On all three scales (anxious-depressive behaviour, attention problems, physical complaints), the level is low even nine months before school entry. The changes over the first one and a half years show only very slight fluctuations. Only in the case of anxious-depressive behaviour there is a tendency towards significant change during the first year of school, indicating a decrease in stress. Moreover, the low values for physical complaints are especially worth mentioning, indicating that this type of problem occurs only very rarely during the transition to primary school (Faust et al. 2012).

With regard to *parents' satisfaction* with their school entry decision, the analysis reveals three types of developmental trajectories. The first and largest group of parents (82.1%) is satisfied with their enrolment decision across all measurement points. The second and smallest group of parents (5.1%) is dissatisfied with their decision from the start. The third group of parents (12.8%) is initially satisfied but becomes increasingly dissatisfied with their decision over time. Predictors of satisfaction include the child's sex (parents of boys are overrepresented in the group of those who are dissatisfied from the start) and the child's linguistic and written language skills, as assessed by their preschool teachers. The child's social-emotional characteristics (e.g., attention deficits) are relevant for parental satisfaction as well. The majority of parents (90%) would make the same school entry decision. Of those who would revise their decision, the majority would rather enrol their children at a later time point. Satisfaction with the decision was not systematically related to the time of enrolment (Kratzmann et al. 2013).

6.4 Cooperation Between Preschools and Primary Schools

Collaborative activities between preschools and primary schools are best described as low-intensity ‘exchanges’. Preschool teachers and primary school teachers report that school visits by preschool children are the most frequent cooperation practice, followed by the general exchange of information. More intensive forms of cooperation (e.g., joint professional development programmes), in contrast, are realized less frequently (Faust et al. 2011).

Generally, preschool teachers and primary school teachers believe that cooperation is important. Both groups attach particular importance to sharing not only general information but also specific information about each child’s strengths and weaknesses. They also strongly support joint parent counselling and school visits by preschool children. Whereas primary school teachers attribute the highest value to cooperation at the interprofessional level (e.g., joint teacher training), preschool teachers think that cooperation between the professions and collaborative activities at the children’s level (e.g., school visits by preschool children) are equally relevant. Overall, preschool teachers attach slightly more importance to cooperation than primary school teachers. Obstacles that can make cooperation more difficult include preschool teachers’ professional secrecy and primary school teachers’ fear of being prejudiced if they receive advance information about a child from its preschool teacher. A lack of time and the size of the primary school district are also named as obstacles (Faust et al. 2011).

Analyses of the effectiveness of cooperation show no positive effects of the exchange between preschool teachers and primary school teachers on the children’s ability to master the transition. The same is true of the children’s visits to each other’s institutions. This practice even had a negative influence on the children’s willingness to make an effort (Faust et al. 2012).

7 Discussion and Outlook

7.1 School Readiness and School Entry

In line with existing research (e.g., Hustedt et al. 2018; Niklas et al. 2018; Ring et al. 2016), our findings prove that parents, preschool teachers, and primary school teachers attach great importance to social-emotional skills as school readiness criteria. Likewise, the high value attributed to cognitive and linguistic skills, as documented in previous research (e.g., Altun 2018; Flender 2009; Kammermeyer 2000; Niklas et al. 2018; Wesley and Buysee 2003), is confirmed in the results of the BiKS-3-18 study (Pohlmann-Rother et al. 2011). Furthermore, again in line with existing research, our findings suggest that pre-academic skills tend to be a stronger indicator of school readiness in the eyes of parents than in the eyes of pedagogues (e.g., Piotrkowski et al. 2000). In addition, our analyses of the qualitative data show that, even though the eco-systemic model of school readiness is well-established in research, parents and educational professionals continue to be guided by criteria-based concepts that primarily define school readiness in terms of the child's characteristics. There seems to be a need for intervention here, for instance by giving preschool teachers and primary school teachers the opportunity as part of their professional training to understand the importance of environmental factors for a child's academic success.

Even though preschool teachers, primary school teachers, and parents think that social-emotional skills are significant school readiness criteria, a major contribution of social-emotional skills to the child experiencing successful school adjustment has not been proven (Duncan et al. 2007). Furthermore, despite the consensus on the school readiness criteria, it is unclear how these skills are understood in detail by each actor. Here too, following the eco-systemic model, exchanges between all actors should be strengthened and a shared understanding of school readiness criteria should be developed.

7.2 School Entry Decisions: Formation and Outcomes

The findings of the BiKS-3-18 study regarding the links between sex, social status, and migration background and parents' school entry decisions are in line with previous studies (Kratzmann and Schneider 2009; Liebers 2011; Tuppat et al. 2016). Existing research results were also confirmed with regard to the decision-making processes and the criteria used by parents. Child-related aspects are found to be the central criteria (Donath et al. 2010; Liebers 2011; Tietze 1973). Whereas parents who enrol their child in school early highlight their child's desire to learn and its interest in school, parents who delay their child's enrolment emphasise their child's existing deficits. In addition to these child-related criteria, parental attitudes towards school are found to be important.

In the sub-samples on early school enrolment, parents see school primarily as a place of support for their child. Parents who prefer late enrolment have a narrow view of school, conceiving of academic expectations as problematic. Preschools, in contrast, are seen as places for play and free development. This discrepancy – school as a demanding institution on the one hand and preschool as a 'place of good childhood' (Andresen et al. 2013) on the other hand – is a key moment for parents' school entry decision. Their weighing of the costs and benefits and the expectations of success associated with a given choice is informed by their ideas of school-based learning and the associated attitudes towards child development. In particular, parents are anxious to find the right fit between perceived school requirements and the abilities and skills they see in their child. In this context, the focus of future interventions should be on parents' ideas about school, their evolution, and the way the institutions involved in the transition influence these ideas. Possibly, the rather critical ideas of school among parents who prefer delayed school entry might be changed by facilitating more intensive encounters with schools and teachers. Dockett and Perry (2007) have already shown that this contributes to a more positive attitude towards the transition among parents.

The BiKS-3-18 findings show that age and children's skills are influential criteria in the school entry decisions of parents with a Turkish migration background as well (Kratzmann 2011). For parents with a Turkish migration background, the fear of being discriminated in the education system also plays a special role in the decision: Whereas some Turkish-speaking parents want their child to start school as early as possible if they have the impression that their child does not receive adequate support in preschool, others hope that delayed school entry and hence extended preparation in preschool will improve their child's opportunities and help them escape the expected discrimination in school. The child-centred educational arguments of Turkish-speaking parents reported by Rachner and Unger (1994) are thus also reflected in the BiKS-3-18 study. However, Turkish-speaking parents who prefer late enrolment for these reasons are not aware of the possibility of equating late enrolment with performance deficits, as claimed by the proponents of institutional discrimination (Gomolla and Radtke 2009), who argue that delayed school entry might work to diminish opportunities in the school system in the long term. The category 'migration background' was thus shown to be significant for parents' school entry decisions in the BiKS-3-18 study. Concerns about educational disadvantages played an important role. Interventions should therefore be found that help reduce this fear. One possible starting point might be a diversity-aware pedagogical approach that could be incorporated into the curricula of preschool institutions and schools following the eco-systemic model of school readiness. However, further empirical evidence is needed to clarify the extent to which this type of pedagogy actually helps reduce fears of discrimination and contributes to the goal of equal educational opportunity in the long term.

Our findings on the success of enrolling children in school at a non-standard age were collected via skills assessments and subjective attitudes. Previous mixed findings on the skills development of children enrolled in school early and late may possibly be explained by different perspectives: When comparing children of the same age, those who start school early achieve higher skills than their peers who do not start school. When comparing children in the same grade in their first year of school, those enrolled early are found to have lower skills than their peers; that difference, however, disappears by the end of the second year. This is in line with previous research, which does not show any serious long-term problems in academic achievement for children enrolled early (Fina 2017; Seyda 2009). In contrast, children enrolled late show a disadvantage in the skills assessed when compared to children of the same age. Positive effects, on the other hand, can be found when comparing children in the same grade, and these positive effects become even stronger for some skills in the second year of school. Delayed school entry thus enables children to build additional skills, facilitating not only their school entry but also their subsequent primary school career. This contradicts most previous findings, which have tended to show no advantages in the development of academic skills (Hong and Raudenbush 2005; Jaekel et al. 2015). It is possible that the advantages balance each other out later in school.

Our findings on the outcomes of school entry decisions from the parents' perspective revealed three types of parental satisfaction. The majority of parents were consistently satisfied with their enrolment decision. Relatively few parents were dissatisfied from the start or became so in the course of time. Their dissatisfaction was not related to the time of enrolment, but rather to child-related characteristics (Kratzmann et al. 2013). This result is in line with existing research on the prediction of successful school careers, which considers the child's individual characteristics (e.g., academic skills) to be central (Duncan et al. 2007). The idea that school entry is a crisis event, as proposed in the transition approach, could not be confirmed. Rather, the BiKS-3-18 results suggest that syndromes remain stable; new difficulties arising from the transition could not be found.

The BiKS-3-18 results suggest that the school entry decision should not be based on timing alone. Successful school entry seems to depend less on a short-term decision than on longer-term developmental conditions and processes. In future, the focus should be on specific groups, such as children with multiple disadvantages. There is also a need for more long-term studies of school entry decisions that go beyond the primary school years and are not only retrospective in scope.

As a general principle, the individuality of each child and its family must be taken into account when making school entry decisions. One limitation of the BiKS-3-18 sample is that all children were born close to the cut-off date, which meant that the issue of early or delayed enrolment was more strongly on parents' minds.

7.3 Cooperation Between Preschools and Primary Schools

The BiKS-3-18 results on the prevalence of various forms of cooperation between preschools and primary schools are in line with existing research (e.g., Hanke et al. 2013; Meyer-Siever 2015). Less intensive forms of cooperation are practised extensively, especially school visits by preschool children. More intensive forms of cooperation, however, take place less frequently. Based on our findings, we were able to add to existing research by identifying some factors that are essential for the formation of collaborative structures. For example, the attitudes of preschool teachers and primary school teachers towards cooperation emerged as one influential factor. Current studies suggest the existence of further factors influencing cooperation between preschools and primary schools. Meyer-Siever (2015) concludes that professional experience among preschool teachers and primary school teachers has a positive effect on their desire for cooperation; among primary school teachers, it also has a positive effect on how they perceive cooperation practices that have actually taken place.

The results of the BiKS-3-18 study on the effectiveness of individual cooperation practices are also consistent with the findings of previous research. As proposed in earlier studies (Ahtola et al. 2011; LoCasale-Crouch et al. 2008), our results also question the positive effects of less intensive forms of cooperation on the development of children's skills at the beginning of school (Faust et al. 2012).

Future research on this issue should take a closer look at the intensity and quality of individual formats of cooperation (including domain-specific formats) and analyse their effects on students' skills development over the course of their primary school years.

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From Primary School to Vocational Training and Tertiary Education—Study Design of BiKS-8-18

Christoph Homuth, Monja Schmitt and Maximilian Pfost

Abstract

This article provides an overview of the study design, the sampling procedure, the applied instruments, and the research potential of BiKS-8-18 "Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age"). BiKS-8-18 is a panel study, which followed students in the German federal states of Bavaria and Hesse from 2006 through 2016 to trace their educational trajectories and competence developments. One of the major aims of the study was to gather suitable longitudinal data to explain previous findings of international large-scale assessments such as PISA, e.g., on the importance of social origin for educational achievements. The study is characterized by an interdisciplinary approach that includes pedagogical, psychological, and sociological perspectives. The study followed students from primary school over their educational career until their transitions from general education into tertiary education or vocational education when they were around 18–19 years old. During their time in primary school and

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secondary school, the study assessed children's competencies and their familial and institutional learning environments. Additionally, children's parents and teachers were interviewed. The initial sample consisted of 2,395 children in Grade 3. In Grade 5, the sample was expanded by further 879 secondary school students within BiKS-8-18 study classes.

Keywords

Primary school · Secondary school · Vocational education and training · Educational trajectories · Longitudinal data

1 Introduction

The aim of the interdisciplinary BiKS study "Educational Processes, Competence Development, and the Formation of Selection Decisions in Preschool and School Age" is the longitudinal investigation of educational and competence development processes. For this purpose, two panel studies (BiKS-3-18; BiKS-8-18) with surveys in the German states of Bavaria and Hesse have been conducted since 2005. This was done against the background of two weaknesses of the German education system, which came to light in the wake of international comparative school performance studies such as PISA 2000 (see e.g., Baumert et al. 2001): On the one hand, students at German schools showed an unexpectedly low level of competence in an international comparison. This was especially true in the lower performance groups and across different competence areas. On the other hand, particularly pronounced disparities in educational participation and skill acquisition had become apparent for students of different social origins and nationalities or migration statuses.

In BiKS-8-18, beginning in 2006, a sample of primary school children in Grade 3 was accompanied for the next ten years of formal education. The transition from primary school to lower secondary school is arguably still the crucial point in the German educational system, and it is critical for the development of social disparities (Maaz et al. 2006). Therefore, the longitudinal study BiKS-8-18 focused on the development of competencies and interests, the formation of educational decisions before and after the transition to lower secondary schooling as well as the continuation of developmental trajectories in lower secondary schooling. Using a multi-method, multi-perspective and multi-level design, the effects of the learning environments of family, primary school, and secondary school, and the interactions between these factors on child development were examined over a period of ten years. On the other hand, BiKS-8-18 focused on the transition from upper secondary school to the vocational training sector and the labor market by surveying adolescents across additional follow-up surveys.

The remainder of this chapter is structured as follows: First, we describe the study design of BiKS-8-18. Then, we describe the sampling and different subsample tracking strategies in detail to understand their limitations and potentials. After that, we provide an overview of the study instruments we used to provide a rich multi-level data set. Finally, we briefly discuss the research potentials of the data by illustrating research that has previously been done with the BiKS longitudinal data.

2 Study Design

BiKS-8-18 can be structured in three phases. The first phase consists of the data collection when the sampled children were in the second half of primary school in Grade 3 until they transitioned into lower secondary schooling after Grade 4. The second phase covers the period of lower secondary schooling until the transition into either upper secondary schooling on their path to tertiary education or into vocational education and training (VET), i.e., from Grade 5 through Grade 9 and 10, respectively. The third phase contains students' time in upper secondary schooling or VET and their transition into either tertiary education or labor market entrance.

2.1 Multi-Perspective Panel Design

The surveys of the first phase of the BiKS-8-18 took place in the states of Bavaria and Hesse and began in spring 2006 in the second half of third grade in 155 classes in 82 primary schools (see Sect. 2.2). The children of the 2,395 participating families were surveyed in three panel waves in six-month intervals. Data collection included the assessment of the children's competencies. These children transferred to a secondary school in the fall of 2007. In the second phase, these children and their parents were followed at annual intervals in five panel waves until the end of ninth grade. In the last phase, the students' transition into upper secondary school to the vocational training sector or the labor market was examined in three additional panel waves (see Fig. 1).

The first and second phases followed a multi-perspective design, which included in addition to student questionnaire and competence tests on the indi-

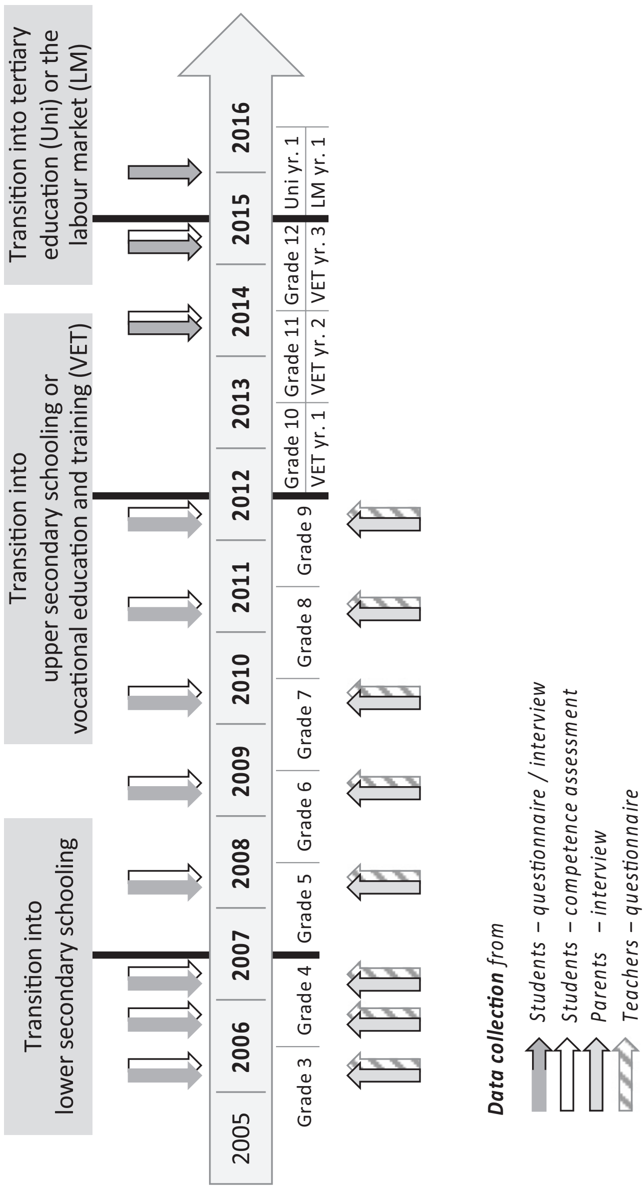


Fig. 1 Study design of BiKS-8-18

vidual level also parent interviews and questionnaires for teachers, thus covering central contexts of the family and institutional learning environment (for further details, see von Maurice et al. 2007). The surveys in the third phase exclusively focused on the individual students.

In primary school, educational trajectories are typically linear and uniform, i.e., with infrequent class or school changes (Bellenberg 2020). With the transition to the various types of secondary school, there is a clear pluralization of school and educational trajectories in Germany: In addition to local school changes, there were also changes in school types and grade level as high performing students could change to a more demanding school type or low performing students may repeat a grade level or even change to a less demanding school type (Bellenberg 2020). Therefore, already in the second phase, surveys in the school context could not be continued equally for all students to cope with this complexity on a practical level. This led to different survey and testing strategies (see Sect. 2.3). Although students were the main target persons, the contact and interviewing strategy differed in the study phases. In the first phase, students were primarily interviewed and tested in the school context, and their parents were the primary contact persons. In the second phase, most students were interviewed in the school context, and some students were surveyed individually. In the last phase, the focus was entirely on the students themselves. Data collection was individualized and without the inclusion of parents or learning context.

To investigate the different research questions longitudinally, 11 panel waves were conducted with a multi-method design in which different survey and test instruments were used. In the first and second phases, the parent interviews were conducted as computer-assisted telephone interviews (CATI). Students and teachers received paper-and-pencil questionnaires (PAPI), and students' competence assessments were also paper-based (PBA). In the third phase, all survey instruments were either CATI or CAWI (computer-assisted web interview). While the CATI was the primary mode in this phase, the CAWI were mainly used to interview students who were difficult to reach by telephone.

2.2 Sampling Process in Two Federal States

The sampling of BiKS-8-18 followed a stratified multi-step process (for details on the sampling process, see Kurz et al. 2007). In the first step, two federal states, Bavaria and Hesse, were selected. The guiding principle for selecting these two states was to vary relevant contextual factors that determine individual educational decisions systematically. On the one hand, these were the state-specific differences regarding the transition regulations from primary school to secondary schools, in which different emphasis was given to the parents' free choice and the school track recommendation. According to the regulations of the state of Bavaria, school track recommendation given by the teacher(s) at the end of primary school was of primary importance, and students without a track recommendation have to pass an additional entrance examination. In Hesse, on the other hand, parents were ultimately free to choose the school type in secondary education (see Faust 2005; Secretariat of the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder in the Federal Republic of Germany 2010). Second, the two states significantly differed in terms of the structure of secondary schooling. In Bavaria, the choice of schools included Hauptschulen (lower track schools), Realschulen (middle track schools), Gymnasien (higher or academic track schools), and in some few cases, Gesamtschulen (comprehensive schools). In contrast, integrated and cooperative Gesamtschulen (comprehensive and multi-track schools) were additional regular school types in Hesse.

In the second step, specific survey regions within the federal states were selected based on similarities and differences in the respective opportunity structures and socioeconomic conditions (e.g., presence of different school forms, accessibility, employed persons by economic sectors). This led to the selection of one large city (Bavaria: Nuremberg, Hesse: Frankfurt), one medium-sized city (Bavaria: Bamberg, Hesse: Darmstadt), and two rural districts (Bavaria: Bamberg and Forchheim, Hesse: Bergstrasse and Odenwaldkreis).

In the third step, primary schools were recruited. The following disproportional distributions of participating schools were targeted: First, disproportional stratification by federal state with a ratio of Bavarian and Hessian schools of 60:40, and second, disproportionate stratification by major cities: One-third of schools each of Bavarian and Hessian schools were to come from the metropolitan regions of Nuremberg and Frankfurt respectively. For practical reasons, this was done to link BiKS-8-18 to the other cohort BiKS-3-18 (see Homuth, Lehrl, et al. this volume). The linkage was supposed to be established by recruiting primary schools named by the preschool teachers of BiKS-3-18 as their most important schools where their students would transition to.

In the last step, parents of students in the participating schools were asked to participate in the survey. This resulted in the initial sample of $n=2{,}395$ participating children in wave 1.

2.3 Different Survey and Test Strategies

BiKS-8-18 started in 2006 with 2,395 participating primary school students and their parents. In the fall of 2007, the majority of the children moved on to secondary schools. The aim of the second phase was to continue to follow the remaining participants of the initial sample ($n = 2,104$, corresponding to 88%) and to expand the sample to include the class context by including their classmates in the study. Since the number of receiving secondary schools was too large to continue to study all participants in the class context together with their new classmates, and not all children transitioned to secondary schools located within the BiKS survey regions, three different survey and test strategies were used (see Fig. 2):

In the first strategy, participants were no longer surveyed in the school context but individually outside their schools. This concerned $n = 802$ children who either attended schools outside the BiKS survey regions or schools with fewer than three children of the initial sample. Furthermore, children were moved to

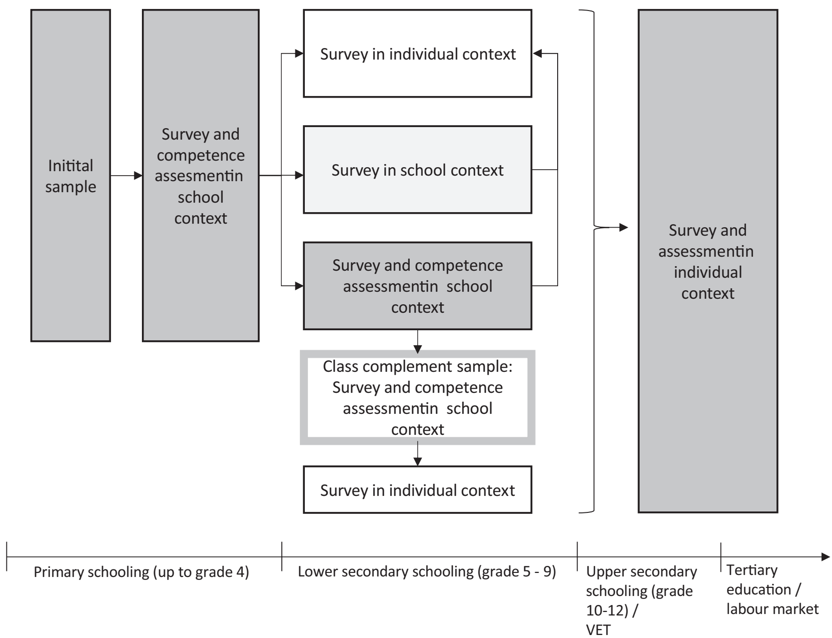


Fig. 2 Survey, interview, and test strategy in BiKS-8-18

individual surveying if no information was available about the secondary schools they attended or if their school generally refused to participate.

In the second strategy, students and teachers were only interviewed via paper questionnaires that were administered by the class teachers within the school context. A total of $n = 382$ children at comprehensive schools, special-needs schools, and schools that did not extend their participation, as well as children at schools in which fewer than three children of the initial sample attended the same class were accompanied this way.

In the third strategy, the remaining $n = 920$ students in schools with at least one class with three or more children of the initial sample were included. For this subgroup, an attempt was made to include the class context, i.e., all their classmates, in the study. This way, $n = 879$ children could be recruited additionally as class complement sample. In these schools, all children of the initial sample and the class complement sample were surveyed and tested in class.

If schools no longer agreed to study participation in class, they were asked to switch to the second strategy without competence testing in class. If a school was also not (anymore) willing to participate in this strategy, all children of these schools finally switched to the individual survey context. Furthermore, it happened that individual children switched from one of the two school survey variants to the individual survey variant due to a change of school or, in rare cases, vice versa, switched to a school that participated in the BiKS surveys.

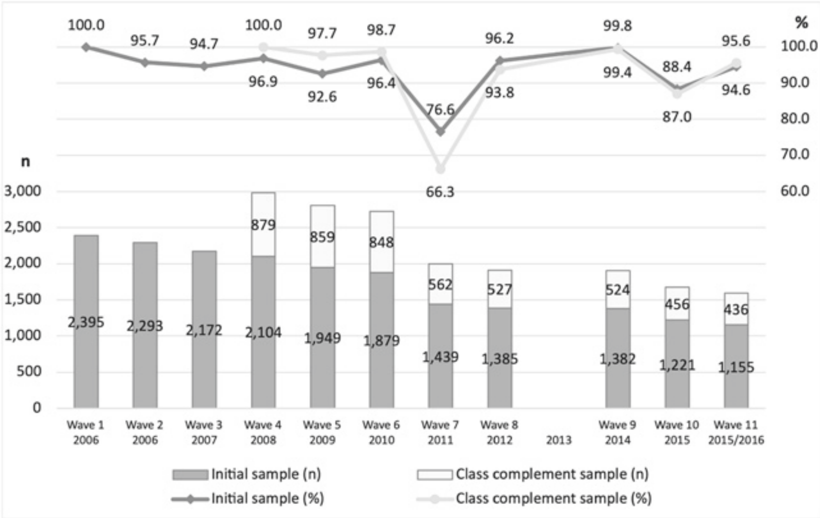
Additionally, to enhance the class complement sample in lower secondary schools (Hauptschulen), $n = 14$ additional students in these schools were included in the sample.

With the beginning of the third phase of the study, all remaining participating students were surveyed and tested in individual contexts.

3 Sample Development and Panel Participation Rates

Figure 3 shows the evolution of the BiKS-8-18 (gross) panel sample over time and panel participation rates[1] differentiated by the initial sample and the class complement sample. Of the $n = 2{,}395$ primary school children sampled initially in wave 1 in 2006, $n = 1{,}157$ (48.3%) were still part of the panel sample at the

[1] Panel participation rate is defined as the share of remaining gross panel sample of the gross panel sample of the respective previous panel wave. Response rates of all instruments by waves are provided in Table 3.



Note: Participation rate in relation to the remaining gross panel sample of the respective previous wave.

Fig. 3 Sample development of BiKS-8–18 (absolute) and panel participation rates (in percent)

end of the study in 2016. Of the $n = 879$ participants who were included in the study as part of the class complement sample in the fifth grade (see Schmidt et al. 2009), $n = 436$ (49.6%) remained until the end of the study. Both the initial and class complement samples consistently showed high participation rates. This could be attributed mainly to effective panel management, which consisted mainly of personal contact, the sending of information material, regular feedback on results, and the effective use of incentives (for a detailed description of the incentivization strategy, see Mudiappa and Schmitt 2010).

Figure 3 also shows that in wave 7, panel participation rates significantly dropped below the average, with only about 68% for the class complement sample and 77% for the initial sample. The drop in the panel participation rate at wave 7 can be attributed to the fact that it became necessary for the Bavarian subsample to obtain written panel consents again. Prior to wave 7 and due to regulatory change in Bavaria, it was necessary to obtain again written consent from the Bavarian families being interviewed in the school context. Since the participating adolescents were already 14 years old at this time, they had to explicitly consent in addition to their parents. Only if both parents and adolescents had given their consent, the family could be interviewed further. Only those families who had actively provided their consent were allowed to remain in the study.

This not only led to a decline in the panel participation rate but also to an aggravation of the selective panel mortality typical for panel studies (for further details, see Homuth et al. 2017). Analyses showed that the high dropout at wave 7 was precisely due to the affected subgroup of Bavarian families in the school survey. In contrast, Hessian and Bavarian families in the individual survey strategy variant did not show a disproportionately high tendency to leave the panel (Homuth et al. 2017).

4 Sample Description

4.1 Basic Composition

Table 1 provides a supplementary overview of the basic sample characteristics and distributions at the beginning and end of each phase. The distribution across the states shifted slightly in favor of Bavarian families from waves 1 to 4 due to the higher proportion of Bavarian families as part of the class complement sample. Classmates in comprehensive schools were not included in the class complement sample, so the lower proportion of Hessian children is due to such study design decisions. In the third phase, in waves 8 to 11, the described selective dropout of Bavarian participants led to a relatively equal distribution across states.

The proportion of girls in the complete sample after the inclusion of the class complement sample was also significantly higher than in the initial sample. Regarding the sample composition in terms of social origin characteristics, shifts in the sample composition from the first to the second phase could be observed in the direction of more highly educated parents as well as parents with an upper socioeconomic position and children without a migration background still participating. This can be explained by the comparatively higher participation rates of families with a high socioeconomic position, of parents with a academic educational background, and of families without an immigrant background in the class complement sample. Higher response rates at academic track schools (Gymnasium) in comparison to other school types are the primary explanation for this change in the sample composition. Accordingly, a disproportionate number of children from this type of school were added. Thus, a larger share of children from homes with these characteristics was newly included in the study.

Table 1 Selected sample characteristics of the longitudinal study BiKS-8-18

Wave	Wave 1	Wave 3	Wave 4	Wave 8	Wave 9	Wave 11
Date	March 2006	June 2007	May 2008	June 2012	June 2014	December 2015
Sample size	n = 2,395	n = 2,172	n = 2,983	n = 1,912	n = 1,906	n = 1,591
Sex	52.2% male 47.8% female	51.8% male 48.2% female	49.9% male 50.1% female	49.8% male 50.2% female	49.9% male 50.1% female	48.4% male 51.6% female
Age in months	M = 110.7 SD = 5.7	M = 125.5 SD = 5.5	M = 136.5 SD = 5.7	M = 185.3 SD = 5.5	M = 209.3 SD = 5.5	M = 227.2 SD = 5.4
Federal state	35.0% Hesse 65.0% Bavaria	34.1% Hesse 65.9% Bavaria	32.3% Hesse 67.7% Bavaria	41.5% Hesse 58.5% Bavaria	41.3% Hesse 58.7% Bavaria	41.0% Hesse 59.0% Bavaria
Socioeconomic status (HISEI)[1]	M = 53.0 SD = 16.2	M = 53.5 SD = 15.9	M = 54.7 SD = 16.0	M = 56.4 SD = 15.7	M = 56.4 SD = 15.7	M = 57.1 SD = 15.7
Highest parental education[2]						
Lower secondary [quali. Hauptschule]	23.7%	22.3%	19.1%	15.8%	15.8%	14.7%
Medium secondary [Mittlere Reife]	33.0%	33.4%	32.0%	30.8%	30.8%	29.3%
University admission [Fach-/Abitur]	43.3%	44.3%	48.9%	53.5%	53.5%	56.0%
Migration background[3]						
Without migration background	75.3%	76.0%	77.7%	76.7%	76.7%	76.7%
At least one parent born abroad	24.7%	24.0%	22.3%	23.3%	23.3%	23.3%

Notes: M = mean, *SD* = standard deviation; *HISEI* = Highest ISEI (International Socio-Economic Index of Occupational Status; see Ganzeboom et al. 1992) in the family
1 Highest value over all panel waves; rate of missing values = 6.5%.
2 Highest value over all panel waves; rate of missing values = 7.4%.
3 Rate of missing information = 8.1%.

4.2 Selectivity

Like in any other longitudinal study, selective panel attrition is a paramount concern (Rendtel 1995). One major question is whether the dropouts were neutral concerning central sample indicators. Overall, continued participation was not systematically biased on the dimensions gender, age of the participants, region, social origin, parental education, and migration background, which taken together accounted for only 0–10% of the total variance in participation in each panel wave (cf. adjusted R^2 in Table A1 in the Appendix).

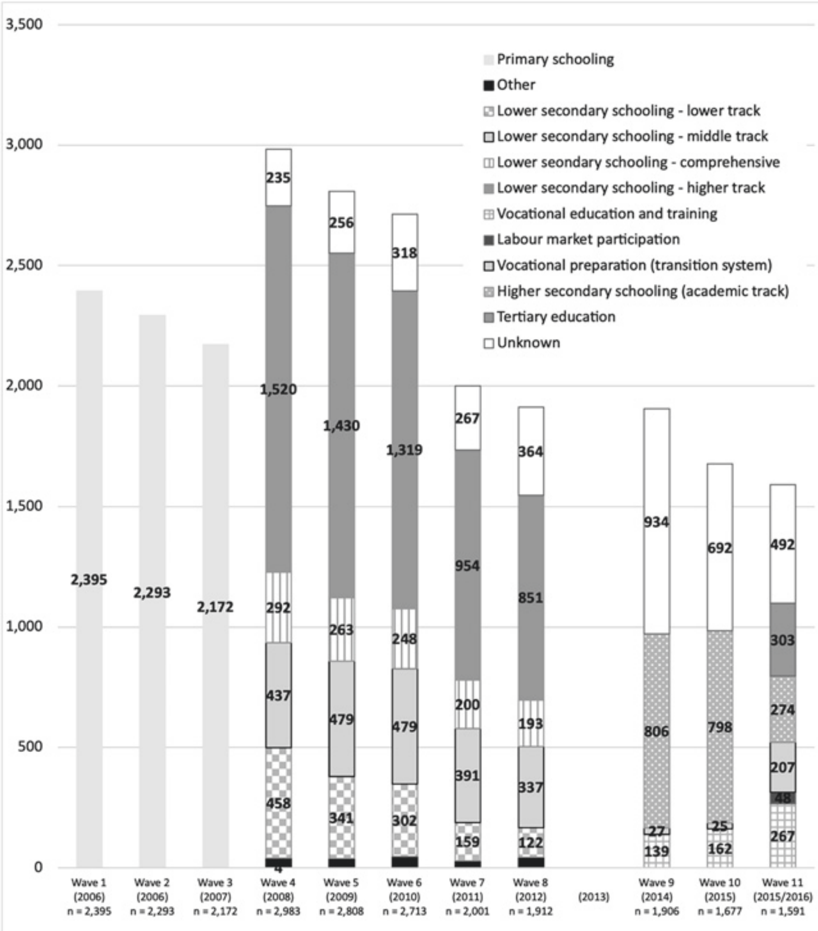
As expected in longitudinal studies (e.g., Behr et al. 2005), the proportion of higher-educated families increased over time as lower-educated families had on average a higher dropout risk. However, the dropouts of participants with less-educated parents mostly occur at specific times (waves 2, 3, 8, and 11) and not each wave. It seems that the parents of the class complement sample were on average significantly higher educated across all waves due to higher participation rates in academic track schools (*Gymnasium*). Concerning the socioeconomic status and the migration status of the participants, no specific attrition patterns can be identified. Mean HISEI and standard deviations vary only slightly both in the group children of the initial sample and the class complement sample. Again, only the differences between the groups are substantial but not between waves.

This also applies to the migration background: At the beginning of the study, 23.6% of the initial sample and 18.8% of the class complement sample had at least one parent who was not born in Germany. At the end of the study (wave 11), the share of migrant students was 23.3%, which is about the same as at the beginning of phase two of the study at the beginning of lower secondary schooling (wave 4).

There were significant changes in composition in the third study phase as the dropout between these last waves was selective along the dimensions of gender, social status, and educational background. Mainly male participants and those from lower education and low social status households left the sample. The dropout was not significantly correlated to migrant background or spatial distribution (federal state).

4.3 Educational Trajectories

In the first phase of BiKS-8-18, all students by design attended primary school. With the beginning of the second phase, i.e., the transition into secondary school, the educational trajectories of the sample start to diverge. Figure 4 shows the educational status of the sample at the respective wave.



Notes: The participants' educational statuses were separated into six categories. The assignment to the respective category was based on the information given at the time of the survey:

- *Vocational education and training* include all respondents undergoing training either in the dual system or at a vocational school.
- *Tertiary education* includes all students enrolled at a university, university of applied sciences, or vocational academy or who are completing a dual course of study.
- *Vocational preparation* includes persons who are neither attending a general school nor undergoing vocational training. This group also includes persons doing voluntary service, an internship, a voluntary social year (FJS) or military service, and persons on stays abroad.
- *Labour market participation* includes all participants who stated in the survey that they are pursuing a professional activity that is not part of a training program or course of study.

Fig. 4 Educational status over time

Due to the selective participation of classmates of the initial sample as part of the class complement sample, the proportion of students attending the higher academic track of secondary schooling was the largest from wave 4 onwards. Due to a change in the survey and assessment strategies, there was a group of participants for whom we do not have the information about their respective educational status or attended school type, respectively.

Educational trajectories further diverged in the third phase of the study. This phase encompassed the transition from lower secondary schooling into either upper secondary schooling or vocational education and training (VET) and beyond. At the end of study phase three, there were still participants who attended a general education school, while others had already entered tertiary education or the labor market.

At wave 9, the majority of the sample ($n=806$) was attending a general education school (mostly higher track school/Gymnasium), $n=139$ were undergoing vocational training, and $n=27$ indicated that they were neither attending school nor in vocational training; no information was available for $n=934$ participants. In wave 10, there were no significant changes; $n=798$ participants were still attending a general education school, $n=162$ were in training, and $n=25$ were classified as participants in vocational preparation (transition system). In wave 11, the picture changes: most participants made a transition. Only $n=274$ participants were still attending a general education school. In contrast, $n=267$ were in VET, $n=303$ had started a tertiary education, and $n=48$ participants had entered the labor market. Interestingly, however, a rather large group of $n=207$ was still in vocational preparation. Among them were a particularly large number of high school graduates who stated that they wanted to take a "time-out" first.

5 Contents of the Study

5.1 Instruments and Measurement Times

Table 2 provides an overview of the instruments by context, when and in which mode they were employed, and their main contexts.

During the first eight waves, students were interviewed by paper-based questionnaires. In the third phase of the study (waves 9-11), students were the single informant, and the interviews were telephone-based. An additional web interview was conducted in the last two waves to interview participants who could not be reached via telephone interview.

Table 2 Overview of instruments

Target / Instrument	*Waves (W)*	*Mode*	*Contents*
Individual level			
Student questionnaire	W1-W8	PAPI	Students' attitudes toward school and learning and their motivation
Student interview	W9-W11	CATI, CAWI	Educational status, aspirations, motivation, interests
Competence assessment (group testing)	W1-W8	PBA	Competency assessment in a classroom context in several domains, including language development, reading comprehension, grammar, cognitive skills, numeracy
Competence assessment (individual testing)	W9-W10	CATI	Verbal fluency tests
Child-related assessment sheet	W1-W8	PAPI	Assessments of abilities, motivation and characteristics of the child's social behavior from the educator's point of view
Family level			
Parent interview	W1-W8	CATI	Housing situation, the family's financial situation, the child's care history, experiences with preschool, the family's endowment with cultural capital, everyday family life, child-rearing and educational attitudes, the child's assessment of social behavior, development, and the child's goals or educational aspirations of the parents for the child
Class level			
Class teacher questionnaire	W1-W8	PAPI	Structural information (e.g., social, ethnic, achievement composition) and teachers' characteristics (e.g., education and attitudes) on the class level

Notes:
CATI Computer-assisted Telephone Interview
CAWI Computer-assisted Web Interview
PBA Paper-based assessment
PAPI Paper-and-pencil Interview (Questionnaire, Test sheets)

Parental data were obtained by interviewing the parents primarily concerned with the children's school matters. These parents were interviewed via CATI (Computer-assisted telephone interview) at all waves during the first two study phases (waves 1-8).

During the first two phases of primary and lower secondary schooling, participants' class teachers were interviewed via a paper questionnaire which included a child-related assessment sheet for each participating student. In the survey group which included students' competence assessment in waves 4 through 8, teachers completed the additional child-related assessment sheet as well. Teachers were surveyed at waves 4 through 8 in both school-based survey groups (with and without competence assessment), analogous to waves 1 through 3. While, in the intensive version, the class and subject teachers (English as a first foreign language, Mathematics, and German) were included in the survey. In the non-intensive version, only the class teacher was asked to participate.

5.2 Response Rates by Instruments and Waves

Numerous instruments were used in the BiKS-8-18 (see Table 3). The assessment of students' competencies and student questionnaires were a central component in the first and second phases of the study. In waves 1 to 3, all children participated in competence assessments and answered questionnaires in the classroom context. After the transfer to the secondary schools, only the subgroup of participants in the third survey strategy provided for differentiated testing of the children's competencies and student surveies were conducted in the interviewer-controlled class context, analogous to the procedure during the primary school period. In the second survey strategy, the response rate was mainly dependent on the cooperation of the participating teachers who handed out the questionnaires themselves. While the response rate in this group was almost as high as in the third survey strategy up to wave 6, response rates declined in waves 7 and 8. In the individual survey strategy, which was highly dependent on the cooperation of the parents, average response rates of about 65% were achieved.

With the transition into the third study phase, participation dropped significantly. When the interviewers contacted them, many participants withdrew their consent to further participation.

The following reasons can be seen as significant for the lower participation rates in Waves 9 to 11 compared to the previous waves:

1. Change of the primary contact person: During the entire duration of the first and second phases of BiKS-8-18, the children's parents were the primary contact persons. The adolescents were not used to being contacted directly and being responsible for their participation in the study.
2. Change of the survey mode: In the first and second phases of BiKS-8-18, the children were interviewed exclusively by paper-based questionnaires, and their parents were interviewed by telephone. However, it was always possible to participate only by sending back the paper questionnaire so that there had always been persons for whom no telephone numbers were available.
3. Greater time interval between interviews: While all surveys (except wave 2) took place at annual intervals in the second half of the respective school year, two school years elapsed between wave 8 and wave 9.
4. Increased mobility: With the end of compulsory schooling and the move to vocational and tertiary education, the mobility of adolescents is increasing, as relocation due to training and studying is unavoidable for many. Additionally, many adolescents spend time abroad either during upper secondary school or after graduating for voluntary service or work-and-travel stays.
5. Reduced accessibility: Adolescents who complete training or vocational preparation usually work full-time and can only be reached in the late afternoon, evenings, and weekends. In some professions, shift work is added to this, further limiting accessibility by telephone.

6 Research Potentials of BiKS-8-18

The BiKS-8-18 study offers a broad dataset that allows high-quality empirical education research within the German education system from an interdisciplinary perspective. Therefore, the BiKS study has contributed and will contribute substantially to a better understanding of educational decision making, learning and teaching processes, and the educational outcomes of these processes.

For example, in the BiKS-8-18 study, a strong emphasis was placed on assessing students' academic competencies and tracing their development from primary to secondary school. Thereby, the focus was on general cognitive abilities, mathematics, oral language and reading skills. Furthermore, psychological variables important for students' academic development such as self-concept, school-subject interests, goals, and motivation were considered. As the BiKS study incorporates the perspectives of students, parents, and teachers, a broad set of variables that may cause individual differences in the development of academic competencies may be explored. Furthermore, as students were assessed within their class

Table 3 Sample sizes and response rates by panel waves and instrument

	Instrument	Mode	Sample	Valid	Response rate in %
Wave1	Child questionnaire	PAPI	2,395	2,202	91..9
	Competence assessment	PBT	2,395	2,276	95..0
	Parent interview	CATI	2,395	2,238	93..4
	Teacher–Child-Rating	PAPI	2,395	2,276	95..0
	Teacher questionnaire	PAPI	2,395	2,247	93..8
Wave 2	Child questionnaire	PAPI	2,293	2,157	94..1
	Competence assessment	PBT	2,293	2,182	95.2
	Parent interview	CATI	2,293	2,022	88.2
	Teacher–Child-Rating	PAPI	2,293	2,093	91.3
	Teacher questionnaire	PAPI	2,293	2,142	93.4
Wave 3	Child questionnaire	PAPI	2,172	2,024	93.2
	Competence assessment	PBT	2,172	2,032	93.6
	Parent interview	CATI	2,172	1,792	82.5
	Teacher–Child-Rating	PAPI	2,172	1,991	91.7
	Teacher questionnaire	PAPI	2,172	2,044	94.1
Wave 4	Child questionnaire	PAPI	2,983	2,431	81.5
	Competence assessment	PBT	1,799	1,636	90.9
	Parent interview	CATI	2,983	2,458	82.4
	Teacher–Child-Rating	PAPI	2,181	1,872	85.8
	Teacher questionnaire	PAPI	2,181	1,862	85.4
Wave 5	Child questionnaire	PAPI	2,808	2,268	80.8
	Competence assessment	PBT	1,562	1,437	92.0
	Parent interview	CATI	2,808	2,218	79.0
	Teacher–Child-Rating	PAPI	1,896	1,680	88.6
	Teacher questionnaire	PAPI	1,896	1,640	86.5
Wave 6	Child questionnaire	PAPI	2,713	2,108	77.7
	Competence assessment	PBT	1,426	1,252	87.8
	Parent interview	CATI	2,727	2,023	74.2
	Teacher–Child-Rating	PAPI	1,751	1,453	83.0
	Teacher questionnaire	PAPI	1,751	1,425	81.4

(continued)

Table 3 (continued)

	Instrument	Mode	Sample	Valid	Response rate in %
Wave 7	Child questionnaire	PAPI	2,001	1,344	67.2
	Competence assessment	PBT	642	526	81.9
	Parent interview	CATI	2,007	1,421	70.8
	Teacher–Child-Rating	PAPI	924	578	62.6
	Teacher questionnaire	PAPI	924	161	17.4
Wave 8	Child questionnaire	PAPI	1,912	1,071	56.0
	Competence assessment	PBT	600	442	73.7
	Parent interview	CATI	1,915	1,184	61.8
	Teacher–Child-Rating	PAPI	873	313	35.9
	Teacher questionnaire	PAPI	873	478	54.8
Wave 9	Adolescent interview	CATI	1,906	972	51.0
	Competence assessment	CATI	1,906	972	51.0
Wave 10	Adolescent interview	CATI	1,678	832	49.6
	Competence assessment	CATI	1,678	832	49.6
	Adolescent interview	CAWI	845	179	21.2
Wave 11	Adolescent interview	CATI	1,593	839	52.7
	Adolescent interview	CAWI	752	261	34.7

contexts, context effects can be analyzed. Some examples for such analyses are provided in Pfost et al. (this volume) and Karing et al. (this volume) of this volume. For instance, in a study by Pfost and Artelt (2013), the effect of attending the upper academic track school (Gymnasium) in comparison to lower and middle track school (Haupt-/Realschule) for reading development between Grade 5 and Grade 7 was analyzed. In another study, Schurtz et al. (2014) analyzed the complex interrelation between students' academic interests, competencies, and grades between Grade 5 and Grade 6. The empirical analyses were embedded within assumptions of the internal/external frame of reference model (I/E model; Marsh 1986) as well as the big-fish-little-pond-effect model (BFLPE; Marsh 1987). Third, Becker et al. (2017) explored the role of learning environments for students' goal orientation. Thereby, the development of students' mastery and performance goals between Grade 5 and Grade 11 was described and related to variables such as the transition from school to vocational training. Or fourth, Karing (2009) analyzed teachers judgement accuracy in reading respectively language arts and mathematics. In her study, judgement accuracy was related to teacher and class characteristics or the whether the judgement refers to cognitive (students' competencies) or non-cognitive (students' interests) outcomes. However, besides analyses conducted by researchers within the BiKS research group, the BiKS-8-18 study still offers an extensive range of further possible analyses. For example, analyses that relate individual differences in academic competencies when children were in primary school to education decisions and pathways at the end of secondary school, including the transition into tertiary education, are still scarce.

Another strong emphasis in the BiKS-8-18 study was on the educational decision-making process of parents (and teachers), its surrounding activities, and the influence of social relations before and after the transition from primary to secondary school in Germany. Researchers from the BiKS group examined and compared differences of family background, family aspirations, family burden, family social networks, and institutional differences in the federal states of Bavaria and Hesse on educational outcomes (see Blossfeld et al. this volume): The parental educational aspirations are an essential factor in the decision-making process. Parental aspirations can be understood as representations of parents' expectations about their children's possible future educational pathways (Kleine 2014; Kleine et al. 2010, 2013). In addition, Luplow and Schneider (2014) and Luplow (2017) examined the role of tutoring by parents at home or through non-familial institutions during primary school years—as possible tools for parents to pursue their educational goals—on educational outcomes. Further studies addressed the influence of families' social capital and family burden on their children's educational success in their analyses (Kleine 2014; Kleine et al. 2013; Luplow 2017; Schmitt 2012; Schmitt and Kleine 2010; Schmitt and Sixt 2014). After the transition to secondary school, the revision and stabilization of previously made school transition decisions, especially with regard to differences in the school type choices in Bavaria and Hesse was analyzed (Zielonka 2017; Zielonka et al. 2013; Zielonka et al. 2014).

In sum, there is still plenty of potential in the data of BiKS-8-18 to further contribute to a better understanding of competence development, educational pathways, and decisions. This rich data set allows researchers to relate these educational trajectories with later transitions into university studies, vocation training or work, taking into account individual differences between students and families from an earlier point in time. Due to its multidisciplinary perspective, the BiKS-8-18 study can still offer interesting empirical answers to open research questions. Furthermore, research that takes the complex interactions of different actors such as parents, teachers, and the student within different educational contexts and across different educational stages into account is still warranted.

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Appendix

See (Table A1).

Table A1 Explaining continued participation in the study

	W2	W3	W4	W5	W6	W7	W8	W10	W11
	AME (SE)	AME (SE)	AME (SE)	AME (SE)	AME (SE)	AME (SE)	AME (SE)	AME (SE)	AME (SE)
Sex: Female (Ref. Male)	0.015	−0.005	0.002	0.012	0.007	−0.002	0.034	−0.023	0.060*
	(0.009)	(0.010)	(0.008)	(0.008)	(0.007)	(0.017)	(0.010)	(0.003)	(0.015)
Age in Months	−0.037	0.012	0.014	−0.018	0.023	−0.004	0.005	0.004	−0.015
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.001)	(0.000)	(0.002)
Federal State: Hesse (Ref. Bavaria)	0.001	−0.083**	0.012	0.004	0.025	0.302**	0.054*	−0.045	−0.030
	(0.009)	(0.012)	(0.009)	(0.009)	(0.007)	(0.015)	(0.010)	(0.004)	(0.016)
Socio-economic status (HISEI)	0.071*	0.062	0.015	0.115**	0.032	0.114**	0.003	−0.014	0.077**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.000)	(0.000)	(0.001)
Parent education (Ref.: University admission [Fach-/Abitur])									
Lower secondary [quali. Hauptschule]	0.010	−0.086**	−0.010	−0.010	−0.054	0.010	−0.073*	−0.036	−0.061
	(0.014)	(0.017)	(0.015)	(0.015)	(0.013)	(0.029)	(0.020)	(0.007)	(0.028)
Medium secondary [Mittlere Reife]	0.054*	−0.002	0.019	0.005	−0.009	0.008	−0.037	−0.034	−0.061*
	(0.011)	(0.012)	(0.010)	(0.011)	(0.010)	(0.022)	(0.012)	(0.006)	(0.020)

(continued)

Table A1 (continued)

	W2	W3	W4	W5	W6	W7	W8	W10	W11
Migration background (Ref.: Child and parents born in Germany)									
At least one parent or child born abroad	0.005	−0.035	−0.076**	0.005	0.005	0.022	0.036	0.022	0.035
	(0.011)	(0.014)	(0.012)	(0.011)	(0.009)	(0.021)	(0.011)	(0.004)	(0.019)
Adjusted R^2	0.004	0.020	0.004	0.013	0.003	0.103	0.008	−0.000	0.019
N	2395	2166	2076	1970	2691	2557	2477	1835	1751

Notes: Results from linear probability models to predict continued participation in the study; sample sizes represent the remaining participants from the previous wave; standardized average marginal effects, standard errors in parenthesis; * $p<0.05$, ** $p<0.01$

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Competence, Motivation and Interest Development Between Primary School and Tertiary Education—a Summary of Findings from the BiKS-8-18 Study

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Abstract

Within the BiKS-8-18 study ("Educational Processes, Competence Development, and Formation of Educational Decisions in Preschool and School Age"), the academic career of more than three thousand students from primary school up to tertiary education was observed. The longitudinal study design encompasses ten years of data collection on students, teachers and parents using a wide range of instruments. In this article, we summarize research findings on three major research questions. First, we discuss the development of reading comprehension in primary and secondary school, focusing on the exploration individual differences and the Matthew-effect. Second, we present research on students' academic interests in secondary school and the role of social and dimensional comparisons

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for the development of individual differences. And third, we illustrate findings on the development of students' goals at the transition from secondary school to tertiary education. Finally, a comprehensive outlook is provided.

Keywords

Reading comprehension · Achievement goals · Academic interests

1 Introduction

Analyzing the development of students' cognitive competencies, motivation, and interest from primary school up to secondary school and tertiary education was one of the major aims of researchers from the Bamberg BiKS research group. Understanding success and failure, exploring individual trajectories of learners that will finally initiate university studies whereas others decide to leave school in an earlier point of their academic career in order to follow vocational training, was and still is of major importance: for politics and public administration, as it is for teachers, parents and every individual student. Starting in year 2006 with a first sample of more than two thousand third grade students, the BiKS-8-18 study followed the academic career for a total period of ten years and eleven waves of measurement (see Homuth et al. this volume).

Concerning the design of the BiKS-8-18 study, three principles were guiding. The first principle was the idea of analyzing students' competencies, interests and motivation longitudinally. In comparison to cross-sectional studies, this offers the possibility to describe interindividual differences as a developmental process in time, which allows a better understanding of causes and variables affecting students' education outcomes. Within the BiKS-8-18 study, students were observed between grade 3 and the beginning of university education and vocation training. This also allows the analysis of two critical transition points in the German education system: the transition from primary to secondary school, as well as the transition from secondary school to tertiary education. Second, within the BiKS-8-18 study, learning was considered as a process that is affected by various influencing factors and a plurality of stakeholders with different perspectives. Therefore, a wide range of instruments including competence tests, self-assessments and questionnaires or interviews were come into use. Furthermore, data collection encompassed children, teachers and parents. The third principle of the study was multicriteriality: In addition to academic achievement and competence development, psychosocial variables such as self-concept, interests, test-anxiety or school and family climate were observed. These variables were further analyzed as outcomes of education processes and decisions.

In the following sections of this article, we will illustrate major empirical findings using data of the BiKS-8-18 study. Thereby, we focus on three aspects of academic development: At first, we report major research findings on the development of reading comprehension in primary and secondary school. Then, we present research findings on the development of students' academic interests. Third, studies on the development of students' motivation with a specific focus on students' goals and goal orientations are presented. Finally, a summary and an outlook are provided.

2 The Development of Reading Comprehension in Primary and Secondary School

To read and to understand written text is essential for participation in the economic, cultural and democratic opportunities. Therefore, the teaching and learning of reading comprehension is at the core of education within schools all around the world. However, besides the claim that all students and adults should dispose sufficient reading skills in order to be able to master these demands, national and international comparisons such as PISA (Reiss et al. 2019), PIRLS (Hußmann et al. 2017) and PIAAC (Rammstedt 2013) have shown that a substantial proportion of students and adults have difficulties to fulfill these requirements. However, cross-sectional studies provide only short-term insights into individual careers. Therefore, it was one of the major aims of the BiKS study to better understand the development of interindividual differences in reading comprehension. Following a longitudinal approach, the BiKS study provides solid empirical data for the description of individual trajectories of students in reading. In addition, conditions and variables that have an influence and relate to these developmental differences can be explored.

The research and findings on the development of reading comprehension presented below are embedded in the theoretical concept of cumulative development in reading as described in detail by Pfost (2016). Focal points of this concept are: (1) reading skills develop in a continuous matter as current states arise out of preceding states and forces; (2) students are selected to and actively choose specific learning environments and conditions in line with their genetic disposition and prior learning experiences; and (3) without intervention to specific groups, interindividual differences in reading increase as students grow older (the Matthew-effect). We report findings from three different studies. First, the hypothesis of increasing individual differences in reading comprehension between grade 3 and grade 4 (the individual Matthew-effect) was tested. In the second study, differences in the development of reading comprehension between different secondary school tracks (the institutional Matthew-effect) were explored. And third, further going into mechanism, findings on reciprocal relations between reading comprehension and extracurricular reading are presented.

In the first study, authored by Pfost et al. (2012), the authors were interested in analyzing the development of individual differences in reading comprehension in primary school. Relying on the idea that initial advantage begets further advantage (the Matthew-effect; Merton 1968; Pfost et al. 2014; Rigney 2010; Stanovich 1986), the development in reading comprehension of a subsample of poor readers in comparison to their normal and better reading classmates between grade 3 and grade 4 was analyzed. Poor readers were defined based on two criteria: The readers scored one standard deviation below the mean within the age-related population norm, as provided within the test manuals, in first reading fluency/reading speed, measured by the SLS 1-4-test (Mayringer and Wimmer 2005), and second reading comprehension, measured by the ELFE 1-6-test (Lenhard and Schneider 2005). Using latent growth curve models to analyze differences in the development of reading comprehension between these two groups of students, the poor readers showed a lower linear growth component in comparison to their better reading classmates. Due to differences in the quadratic growth component, this trend even accelerated over time. In an additional analysis within this study, the authors were further interested to know, whether such increasing difference in reading comprehension over time may be related to students' general cognitive abilities and students' reading behavior. The findings showed a clear relation to students' reading behavior: Increasing differences in reading comprehension were mediated by individual differences in frequency of extracurricular reading for pleasure.

In the second study, authored by Pfost and Artelt (2013), the authors were interested to know, whether, after the transition from primary to secondary school, students attending upper academic track schools (Gymnasium) differ in the development of reading comprehension from students attending lower (Haupt-) and middle academic track schools (Realschule). Within the German education system, students are stratified to different academic tracks mainly due to academic performance. Nevertheless, the final decision of a certain school track also depends on the parents. Further depending on the regulations of the federal states, school track choice there can be understood as an interplay between school recommendation and parents' will (Faust 2005). This may also result in students not attending the recommended school tracks (see Pfost et al. 2018, for findings on consequences of such decisions). Furthermore, it was assumed that school tracks differ with regard to the learning environments they provide, favoring academic competence development within the highest academic track (Baumert 2006). Taken together, individual differences in reading development might be characterized not just by an individual but also by an institutional Matthew-effect. Analyzing the development of reading comprehension between grade 5 and grade 7, the results show higher competence gains for students attending upper academic track schools in comparison to middle and lower academic track schools (interestingly and contrary to the assumptions outlined above, an inverse pattern was found for vocabulary development). Furthermore, applying methods of propensity score matching, the authors explored differences in reading comprehension development between students attending upper academic track schools in comparison to students attending lower and middle academic track school under the precondition of comparable individual characteristics. Controlling for grade 4 competencies such as vocabulary, spelling, reading comprehension and mathematics, as well as variables such as reading self-concept or parents' education and migration background, results still show a minor positive effect of attending upper academic track school for reading comprehension. Although limitations such as small sample size lead to imprecise estimates, descriptively, attending three years upper academic track school in comparison to lower and middle academic track schools summed up to a difference in reading comprehension of about a third of a standard deviation.

And finally, in the third study, authored by Pfost et al. (2010), the authors explored one of the assumed major mechanism behind the individual Matthew-effect in reading: the virtuous circle of reading or respectively the vicious circle of non-reading. Relying on prior research by Stanovich (1986), Morgan and Fuchs (2007), or McElvany et al. (2008), it was expected, on the one hand, that extracurricular reading positively affects students reading comprehension. On the other hand, higher reading comprehension was expected to result in comparatively higher reading engagement. Students' frequency of extracurricular reading for pleasure and students' reading comprehension between grade 3 and grade 5 were analyzed applying cross-lag panel models. Small but significant cross-lagged effects could be found: in addition to autoregressive effects, reading behavior had a positive effect on reading comprehension ($\beta = 0.15/0.08$). And vice versa, reading comprehension positively affected reading behavior ($\beta = 0.15/0.16$). Interestingly, in depth analyses showed, that within families of lower education background, no such cross-lagged effects were present. This has led to assume that, for example in addition to time and frequency of reading, moderating variables such as the quality of the reading material seem to be at work (see Locher et al. 2019; Pfost et al. 2013, for further analyses on the moderating effect of text genre and text difficulty).

3 Students' Academic Interests—Patterns and Trends

It was one of the major aims of the Bamberg BiKS studies to incorporate a broader look on students' development through their education pathways. In addition to students' competencies, data collection and analyses also focused on individual differences in academic interests. Education attainment could be regarded from the perspective of skill and will. For example, good readers are not just capable of reading and understanding text, but also motivated and engaged in reading (Cambria and Guthrie 2010). Therefore, it seems little surprising that prior research has emphasized the role of individual interests for learning and competence development (Schiefele 1991; Schiefele et al. 1993). In line with the theoretical framework by Krapp (2002), academic interests were defined as a specific person-object relationship that is characterized by emotional- and value-related aspects. Individuals like to be engaged with objects respectively topics and activities that are of high personal significance and are accompanied of positive experiential states. Concerning the development of academic interests, several studies have shown a negative trend on the development of school subject-interests as students grow older (Dotterer et al. 2009; Jacobs et al. 2002; Schurtz and Artelt 2014). Therefore, despite an increase of academic competencies in the course of schooling, students often become less interested in their school subjects, which is likely to flatten out academic development. However, recent studies also indicate that interest stagnates in late adolescence and even tends to increase to the end of secondary school (Dotterer et al. 2009). The mean drop of interest over time is often explained by a process of interest differentiation (Todt and Schreiber 1998): In the course of schooling, students focus their interests on a few subjects, while interests in the remaining subjects decline. Both assumptions were explored by Schiefer et al. (2018), who analyzed longitudinal data on students' school subject-interests in German language arts, English and mathematics. Analyses encompass seven waves of measurement between grade 4 and grade 11. First, results show a decreasing trend in subject-interests between grade 4 and grade 9. However, between grade 9 and grade 11, a slight descriptive increase in students' subject interests was observed. Furthermore, correlations between subject-interests in English and mathematics decreased over time, congruent to the assumption of a differentiation process between these two subject-interests. Second, latent class analyses revealed five latent classes, which show quite different patterns of the development of students' school subject interests. However, only within two latent classes a developmental pattern congruent to the assumption of increasing differentiation of interests was observed. This points to the perils of a variable-centered approach and the advantage of a person-centered approach: Just focusing on a general trend in interest development not necessarily applies to a majority of students. When taking a closer look, different patterns emerge. This opens the field for the search on further variables explaining causes of these different trends.

Therefore, within the study by Schurtz et al. (2014), the development of students' academic interests in mathematics and English (as the first foreign language) was analyzed in relation to students' individual competencies and school grades in the two school subjects. Furthermore, students' class context was considered. The study basically relied on two theoretical assumptions: First, according to the internal/external frame of reference model (I/E model; Marsh 1986), it was assumed that academic competencies within the mathematics/ English domain were positively related to students' subject interest within the mathematics/ English domain, but negatively related to students' subject interest within the non-matching domain. Second, by relying on the big-fish-little-pond-effect model (BFLPE; Marsh 1987), it was expected that the average achievement level of the class context within one domain was negatively related to the students individual interest within this domain. Therefore, average achieving students should feel less competent and develop a lower subject interest within this subject within high-achieving classes in comparison to low-achieving classes. Analyzing data of 1390 sixth-grade secondary school students within 106 classes, these two assumptions were tested separately as well as in a joint model using a multi-level modeling approach. The empirical findings well supported the theoretical assumptions: First, students' mathematics competence was negatively related to students' English subject interest and students' English competence was negatively related to students' mathematics subject interest. This supports the I/E model of dimensional comparisons. Second, average class achievement in mathematics and English negatively affected students' mathematics and English subject interest, supporting the BFLPE model. Third, with the exception of the dimensional comparison effect of mathematic competence on English subject interest, effects of social (BFLPE) and dimensional (I/E model) comparisons remained stable when both effects were considered simultaneously. Fourth, within both domains, at least a partial mediation of both comparison effects via students' individual grades and self-concept was found. Finally, this pattern was also found for the development of students' subject interest in mathematics and English from grade 5 to grade 6. In sum, the development of students' school-subject interest has shown to be complex as it is influenced by different standards of comparison.

4 The Development of Students' Goals at the Transition from Secondary to Tertiary Education

Goals and goal striving affect our daily thoughts and actions. Especially for students shortly before leaving school, goals can be seen as "navigating tools" for successful transition from school to tertiary education and future career (Litalien et al. 2013; Nurmi 2001). Previous research has shown that some goals are more beneficial than others. Especially goals which individuals pursue for intrinsic reasons (e.g., interest, enjoyment, etc.) seem to have a positive impact on variables such as well-being or educational performance (e.g., Anderman et al. 2002). Furthermore, goals and goal striving can be specified according to the situation or context in which they were set. For example, life goals can be seen as a kind of broader goals, which are relevant in different situations or contexts. More specific goals may structure certain situations such as goal orientation in educational settings. Goal orientation theory concerns the questions of how and why individuals behave in certain ways in different learning and performance situations. One of the empirically most well-documented finding for goal orientation development is a decrease in mastery-goal (the aim of developing one's own competencies and skills as well as learning new things) and an increase in performance-goal orientation (the aim of demonstrating one's own competencies and skills) after the transition from primary to secondary school (e.g., Anderman and Midgley 1997). One possible explanation for this development is that changes in contextual conditions result in a misfit between a learner's needs and the learning environment (Eccles et al. 1993). Another explanation are evident goal structures in the classroom. These provide a theoretical framework describing different teaching practices and the learning atmosphere as either mastery or performance oriented (Roeser et al. 1996) and which affect students' motivation.

However, findings on the further development of goal orientation and its relation to educational transitions within older students are scarce. One of the major goals of the BiKS study was the examination of the development of goal orientations and the description of influencing factors (e.g. parental motivation, environmental factors). Furthermore, correlations with other motivational constructs like life goals in students and young adults are analyzed. By using a longitudinal approach, the results of three studies provide important empirical insights into motivational development and explanatory factors from secondary school up to the transition into university or vocational training.

In the first study, authored by Becker et al. (2017), the authors examined the development of students' goal orientation at the beginning of secondary education as well as during the transition from secondary school to higher secondary education (grade 11). In addition, the authors compared the results with peers who started a vocational training after graduating from secondary school. To examine whether the transition to vocational training is associated with a better fit between learners' needs and the learning environment, individual reasons for choosing the field of vocational training were also analyzed. For students who moved to higher secondary schools, the authors expected an increase of performance goal orientation because the learning environment is quite competitive with a strong focus on grades. In contrast, for students who started vocational training, an increase in mastery goal orientation was expected, because these students can to a greater extent choose their training according to individual competencies and interests. This is a key factor for an optimal stage-environment fit. Concerning the development of mastery goals, the results show at first decreasing mastery goals at the beginning of secondary education. This was followed by an increase in mastery goals between grade 6 and grade 11. In addition, this increase in mastery goals was stronger for students who started vocational training in comparison to students who moved to higher secondary schools. Furthermore, it was assumed that this increase, especially in the group of trainees, might be related to a better stage-environment fit and changes in the goal structure of the new learning environment. This assumption found support in the data: an indicator of the reasons for choosing vocational training, which might be seen as a proxy of the perceived fit, showed that almost all trainees started the vocational training that corresponded to their first choice. In addition, the results show that interest, talent, and previous experience were the main reasons for their choices. Finally, the results show a decrease of performance goal orientation in both groups.

The second study, authored by Becker et al. (2018), focused on the question whether the increase of mastery goal orientation after the transition into upper secondary school or vocational training, which was found in study 1, could also be observed two years later, when students have graduated from higher track secondary school and have started university or vocational training. Additionally, the authors were interested in the further development of goal orientations of the trainees who chose vocational training earlier. The authors further explored the fit between the students' needs and the conditions in the new educational context to elaborate on the fit hypothesis. Therefore, students' internal (interest, talent, previous experience) and external (earning opportunities, reputation, admission requirements) reasons for choosing the field of study at university or vocational training were analyzed. The results indicated increasing mastery-approach goals for higher track graduates after they transitioned to a new educational context. Furthermore, there was a slight decrease in performance-approach goals. Additionally, an adequate fit between the learners' needs and the new educational context was found as graduates on average stated more internal than external reasons for choosing a field of study or vocational training. Within the group of students who started early vocational training after grade 10, mastery-approach goals seem to remain stable during three years of vocational training. Furthermore, students who started early vocational training reported higher performance approach goals in time 1 (grade11/1st year of vocational training) in comparison to their peers who stayed at higher track school. However, between the 1st and 3rd year of vocational training, performance approach goals decreased. The decrease in performance approach goals over time was stronger for students who started early vocational training in comparison to higher-track graduates.

An explanation that is compatible with these results is the theory of goal structures, which postulates an impact of contextual conditions, teaching methods, and learning atmosphere on the development of goal orientation (e.g., Roeser et al. 1996). In particular, previous studies have shown that vocational training emphasizes the development of subject-specific competencies and their practical implementation (Pätzold 2006; Weigel et al. 2007), and therefor provides a mastery-oriented learning environment. Furthermore, after the transition to university or vocational training, students reported decreasing performance-approach goals. According to the theory of goal structures and its impact on the development of goal orientation, it is to hypothesize that the new learning environment is characterized less by performance-approach goal structures, which could be an explanation for the observed decrease of performance approach goals.

Taken together, study 1 and 2 emphasize the impact of the transition from school to a new educational context on the development of goal orientation. We assumed that an increasing fit between the learners' needs and the contextual conditions results as a consequence of the transition to a new learning context which finally leads to changes in motivation. The transition to a new learning context, university education and vocational training, which have both shown to be predominantly chosen by internal reasons like interest or talent, seems to motivate students intrinsically.

In addition to the development of motivational constructs like goal orientation, we were also interested in analyzing relations between different motivational constructs. Thus, the purpose of study 3, authored by Becker et al. (2019), was to examine relations between different types of goal regulation in specific contexts and education-related parenting behavior as explanatory variable. For this sake, the authors analyzed life goals, their regulation and goal orientation of students in their last year of higher track school (grade 12). As already mentioned, goal-related behavior can be structured according to a hierarchical model describing goals as ranging from a global, broader level to a more situational one (e.g., Carver and Scheier 1999; Vallerand 1997). For the regulation of life goals, as an example for broader goals which can be relevant in different situations, we rely on the theoretical framework of self-determination theory (Deci and Ryan 1985, 2000). In this framework, four types of regulation are described according to a person's level of perceived autonomy during the process of goal striving: extrinsic, introjected, identified, and intrinsic regulation. For goals on a lower level of the hierarchical structure and within a more specific context, we focused on goal orientation—students' mastery and performance goals.

First, by using a person-centered approach, the results show three different profiles of life-goal regulation. The main differences between these three profiles appear according to the amount of more extrinsic types of regulation, which encompasses both introjected and extrinsic regulation. The first latent class is characterized by quite low scores on all four regulation types. The second latent class reported highest scores on intrinsic regulation and had average to high scores on identified regulation. Finally, the third latent class was characterized by the highest scores on introjected and extrinsic regulation. Furthermore, meaningful associations between these life goal regulation profiles and goal orientation were found. In line with theoretical assumptions in the context of goal hierarchies, the life-goal regulation profiles, as an example of higher ordered goals, predicted goal orientation, which can be seen as goals on a lower level. This relation could be observed in particular for goals with more extrinsic characteristics. For example, the authors found students within latent class three, which is characterized by more extrinsically oriented types of life-goal regulation, to also report higher performance-approach goals. Finally, prior research has shown that goal-related behavior is influenced by different external variables (Lekes et al. 2010; Massey et al. 2008). Searching for precursors of patterns of goal orientation, the authors tested whether parental behavior during childhood still relates to goal regulation in grade 12 students. Consequently, the prediction of education-related parenting during secondary school (grade 5–9) for later goal regulation of their grown-up children was explored. The empirical results show that goal-related behavior in adolescence could be predicted by external factors like education-related parenting.

5 Summary and Outlook

The BiKS-8-18 study provides a rich data base on the development of competence, motivation and interest from students aged 8 to 18. Concerning the developmental trajectories of reading comprehension, we found support for an overall tendency of increasing achievement gaps, on the one hand on an institutional level and on the other hand on an individual level. These finding are in line with the Matthew-Effect (Stanovich 1986) and theories of practice engagement (e.g., Reder et al. 2020). The particular importance of reading engagement and practice has also been proven in recent studies from adult samples: Drawing on data from Starting Cohort 6 (Adults) of the German NEPS, the subgroup of low-literate adults was identified using a bookmark standard-setting procedure (Durda et al. 2020). After six years, 32% of these low literate adults ascend to the group of literate adults, particularly if they indicate more reading practices (Wicht et al. 2021). Likewise, reading practices appear to be an important protective factor of descending from the higher literacy to the lower literacy group. Reading literacy thus is not set in stone: Reading practice not only contributes to growing disparities (Matthew effect) but also serves as a protective factor and can lead to improvement in reading comprehension. Nevertheless, the link between conative, cognitive and affective variables on the individual level and—partly as a consequence of selection mechanism—also on the contextual level is strong, opening a wide field for future research and intervention practices.

Elaborating further on the role of conative, cognitive and behavioral factors, the results of the BiKS-8-18 study on interest development can be summarized as follows: Despite the well documented decline of students' academic interest over the school years, which is in line with the process of interest differentiation, interest still matters for educational attainment. We were able to show evidence for interest differentiation processes for some students. In line with the literature, overall we observed first a decrease in academic interests, which was followed by an increase in interests in grade 11. In addition, interest differentiation was observed in grade 11 for two out of five latent classes. Therefore, students tend to differ in processes of individual development of school subject-interests. However, future research is needed in order better understand these interindividual differences in intraindividual change of students' academic interests. Furthermore, the development of students' academic interests in two subject domains in relation to students' individual competencies and school grades in the corresponding and non-corresponding school subjects (referring to the I/E model; Marsh 1986) as well as in relation to students' class context (BFLPE; Marsh 1987) were analyzed. We thereby found evidence supporting both, the I/E model of dimensional comparisons and the BFLPE model and were able to show that effects remained stable (with one exception) when both effects were considered simultaneously. Furthermore, the effects were partly mediated via students' grades and self-concepts. Taken together, the development of students' school-subject interest seems to be influenced by different standards of comparison, in interplay with evaluative and achievement-related variables. Therefore, when it comes to the practical question of how to promote students' interests in school learning and how to prevent the often observed negative trend in school subject interest in the course of secondary school, these different standards of comparisons are important to consider (see Schurtz and Artelt 2014; for further findings using data from the BiKS study).

Then, we analyzed the role and developmental dynamics of goals and goal regulation. Parallel to the decrease in interest development at the transition from primary to secondary school, mastery goals are often reported to decrease whereas performance goals increase (e.g., Anderman and Midgley 1997). However, when studying the development of goal regulation beyond the first years of secondary school, we were able to show differential patterns. We found an increase in mastery goal orientation, which occurred especially for students after transition to vocational training. Furthermore, and line with our theoretical assumptions, this increase turned out to be related to a better stage-environment fit and changes in the goal structure of the new learning environment. Comparable results were found for students graduating two years later from higher track secondary school and who start university or vocational training. The results showed that in the course of transition to a new learning context, the subject of tertiary education and the type of vocational training was predominantly chosen by internal reasons. Finally, we examined the relations between different types of goals and goal regulation together with education-related parenting behavior as explanatory variable. Our findings show meaningful associations between life goal regulation profiles and goal orientation as life-goal regulation profiles predicted goal orientation. Furthermore, the association between education-related parenting behavior and students (later) goal orientation can be regarded as a proof of external factors affecting goal related behavior. In sum, our results on goals and goal regulation show both, dynamic and stables processes of motivational behavior. Dynamic patterns occur especially after transition into self-chosen environments (stage-environment fit). Stable processes and patterns on the other hand were predicted by students' individual needs and environmental conditions, including parental behavior.

Taken together, whereas cross-sectional comparative education studies such as PISA, PIRLS or PIACC, which are characterized by large sample sizes, provide valuable insights into education outcomes at key stages of the education systems, longitudinal studies such as the BiKS study provide a good empirical basis for the analysis of possible explanations and mechanism. Since in the meantime, in addition to the BiKS study, numerous other longitudinal studies in education research have been conducted and are available for analysis purposes, further research findings on competence, interests and motivation development remain to be seen.

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Teacher Judgement Accuracy—Measurements, Causes and Effects

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Abstract

The formation of accurate judgements on students' performance is often considered as part of teachers' professional competence. Moreover, inaccurate judgements are seen as determinants of social inequality. Using data of BiKS-8-18 on teacher ratings and student performance, the paper gives an overview on different theoretical approaches and operationalization of judgement accuracy as well as their results in terms of homogeneity, stability over time, inter-individual differences and the effects of judgement accuracy on students' further achievement. Primary school teachers outperform secondary school teachers in accurately assessing student performance. Furthermore, judgement accuracy did not show to be a general ability. Applying to different student characteristics, however, related to subject areas/domains it proofed to be a relatively time persistent teacher ability. Teacher judgements are somewhat sensitive to characteristics at the class and student level, although bias

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related to students' gender and social status was not found for teachers at secondary level. We found positive effects of teacher judgements on students' achievement gains, particularly in the domain of reading. Finally, by taking into account an add-on study of teachers' content related knowledge related to judgements on reading performance, we discuss the findings and further highlight the need to take into account judgement purposes and demands in future research.

Keywords

Judgement accuracy · Diagnostic competence · Learning outcomes · Summative assessment · Secondary school

Introduction

Teacher judgements are key to a variety of professional behaviors, including standard settings for lessons, educational feedback on students' performance and the awarding of grades and certificates. Some of these judgements are primarily related to educational goals (e.g., initiating assessment aimed at optimizing students' learning) and thus are labeled formative assessment or assessment ***for*** learning. Others refer to the formal evaluation and summative assessment of students' performance, like grades, certificates and decisions on placement and tracking (Looney 2011; OECD 2012) and are forms of assessment ***of*** learning. Given the range and relevance of teacher judgements, its potential bias and its effects on students' (future) performance, the topic is subject to research in educational and sociological research. Educational research on the topic is often motivated by the fact that judgement formation is an integral component of teacher professional competence (see Baumert and Kunter 2006; Herppich et al. 2018), and the notion of an underlying assessment competence which is regarded as a learnable cognitive disposition. Teachers' professional decisions (e.g., related to adaptive selection of tasks, content and didactic approaches) rely on more or less explicit assessments of students' learning. Furthermore, teachers' placement and tracking decisions are even more dependent on accurate summative assessments.

Thus, a number of studies focus on judgement accuracy and its different operationalizations (see Südkamp et al. 2012 for a review) and study the effects of judgement accuracy (teachers' diagnostic competence) on students' learning gains, partly by taking adaptive instruction as a mediator into account (e.g., Anders et al. 2010; Helmke and Schrader 1987). Based on Esser and Kroneberg's (2015) Model of Frame Selection, sociological approaches often focus on social disparities and bias in teacher judgements (e.g., due to students' social background) and corresponding consequences on students. In a similar vein, Krolak-Schwerdt et al. (2013, see also Artelt 2016) studied teacher judgements according to the social cognition paradigm and argued, that modes of teachers' information processing and the accuracy of their judgements are dependent on the relevance of the according judgement.

Within BiKS-8-18 we were interested in the nature as well as in prerequisites and effects of teacher judgements and their accuracy. Research findings were based either on longitudinal data of the BiKS-8-18 project, or on a specific add-on study focusing on teachers' knowledge prerequisites. BiKS-8-18 panel data allowed us to study the phenomenon of judgement accuracy by focusing on different theoretically sound indices of accuracy as trait- or state-measures and also to analyze their effect on students' progress over the course of different school years in the respective domain. The add-on study focused (pre-service) teachers' content and pedagogical knowledge in the area of text comprehension. By combining these approaches, a significant contribution to the ongoing debate about the necessity of accurate teacher judgements and the impact of teacher judgements on students' further learning could be gained.

In the first part of the article, we will provide an overview of different indicators for measuring judgement accuracy. The second part will shed light on factors explaining inter-individual differences in teacher judgement accuracy. In the third part, we will illustrate major empirical findings from the BiKS-8-18 study on the effects of teachers' judgement accuracy on students' further achievements. And finally, we will shed lights on teachers' professional content-related knowledge for judgements on students' competencies in the domain of reading.

1 Measuring Teachers' Judgement Accuracy: Indicators, Structural Relations, and Descriptive Results

1.1 Indicators of Judgement Accuracy

For evaluating teachers' judgement accuracy, an appropriate criterion is needed. A common approach in the literature is to evaluate judgement accuracy by comparing teacher judgements related to student achievement with students' achievement scores in a standardized test in the respective domain (test as criterion). Research using students' results on a standardized test as a criterion thereby makes use of different indicators of judgement accuracy. The most common indicator measures rank-order accuracy. Here, teacher ratings on students' individual abilities are correlated with students' individual performance on a standardized test; a higher correlation implies higher judgement accuracy, indicating the degree to which the correct rank-order of students is reproduced. Rank-order correlations can be derived using different question types and stimuli. A common approach is a judgement type in which teachers are asked to judge students' academic achievement or general ability on a rating scale (e.g., ranging from poor to excellent). Other studies use teacher judgements of individual students' performance on particular items and tasks and compare these to the actual performance of the student on the specific tasks. Thus, judgement types differ with respect to their specificity: they can be task-specific or global. The corresponding tasks administered to the teachers differ in their demands. For task-specific judgements, more information is available to teachers. For global judgements, however, teachers have to infer which of the students' specific behaviors they consider relevant for their judgement. They also have to decide which detections of specific behavior they will integrate into their overall judgement.

Using data from BiKS-8-18, Karing et al. (2011a) investigated the accuracy of global and task-specific teacher judgements in the domain of reading. The sample consisted of 64 German language teachers and their fifth grade students. For global judgements, teachers were asked to make judgements about each of their students' general reading competence. For task-specific judgements, teachers were asked to predict whether each of the randomly selected seven students would pass or fail each single item on the reading competence test with seven multiple-choice items. A comparison of the accuracy of the global vs. the task-specific judgements was possible by computing class level correlations between the global teacher judgement and students' performance in the BiKS reading competence assessment for global ratings on the one hand and the correlation between task-specific judgements and students' actual performance on the individual items on the other hand. The class level correlations were computed as correlations between teacher judgement and student performance at the class level, and averaged across classes through Fisher-z-transformation. The task-specific judgement was formed by summing up the number of items that the teacher judged the student would pass (each coded as 1) and each student's performance was computed by summing up each student's correct answers (each coded as 1). The comparison revealed that teachers' judgement accuracy was rather low in general (global: $\bar{r} = 0.34$, task-specific: $\bar{r} = 0.20$). However, the rank-order component is higher for global judgements than for task-specific ones. A similar finding for the rank-order component in the domain of mathematics was reported by Karst et al. (2018; global judgements: $\bar{r} = 0.64$, specific judgements: $\bar{r} = 0.36$).

However, for the differentiation and level components the values were more accurate for the specific judgements than for the general judgements (Karst et al. 2018). Karst et al. (2018) argued that these findings might be due to differences in teachers' information processing (e.g., heuristic vs. controlled information processing) depending on the kind of judgement.

Based on the task-specific ratings, three other indicators of judgement accuracy could be derived for a detailed description of the computation of the indicators (see Karing et al. 2011a): The task-specific hit rate, the level component, and the differentiation component. The task-specific hit rate is the share of accurate judgements and was built by summing up the number of items for which a teacher's judgement and a student's actual performance were in agreement, divided by the number of items. In our study the task-specific hit rate of German language teachers was moderately high ($M=0.66$), indicating that although the corresponding rank-order was rather low on the class level, teachers' individual ratings where higher. One explanation for the low correlation could be that the seven items of the reading test did not differentiate well between the students. Such a restriction of variance can depress correlations and therefore lead to an underestimation of the association between teacher judgements and students' actual test performance. Concerning teachers' estimation of the level of students' achievement—computed by subtracting the mean of the percentage of correct students' answers from the mean of the corresponding teacher judgements at the class level—our results ($M=0.08$) are in line with the findings of the recent overview on judgement accuracy by Urhahne and Wijnia (2021): secondary school teachers tend to overestimate the level of students' achievement. The third task-specific indicator reflects the degree to which teacher ratings map the variation of students' achievement in their class. The corresponding differentiation component was calculated as the mean within-class quotient between the standard deviation of teacher judgement and the standard deviation of student actual performance, where a value of 1 shows a perfect judgement accuracy. T-tests for one sample were used to determine whether the calculated differentiation component differed significantly from the value 1. The results for our sample indicate that deviation of students' reading competence was accurately judged ($M=0.94$, $t=1.04$, $p>0.05$). As could be shown previously for global teacher ratings (e.g., Spinath 2005), also for the task-specific ratings only low correlations could be found between the different components of judgement accuracy ($r=-0.06$ to 0.31). Judgement accuracy related to rank-order, level and deviation within a class is not a homogeneous construct. Teachers might score high when reproducing the rank order of the achievement level within the class but fail to estimate the level of performance or the variation within the class—or vice versa. Dependent on the task and the relevance of the according judgements, failure in one or the other judgement component is more or less problematic.

1.2 Dimensionality

Complementary to relations between judgement components (rank-order, level and differentiation component) and types of judgements (global vs. task-specific), we further investigated the structure of teachers' diagnostic competence by focusing on the dimensionality of the ability construct with respect to different areas of evaluations (e.g., students' achievement vs. motivation). Karing (2009) could show that for both primary and secondary school teachers, the judgement accuracy is higher for competence assessment than for the assessment of subject-specific interest. Moderate correlations were found in the cognitive domain (rank-order components: arithmetic: $\overline{r} = 0.52$ to 0.65; vocabulary: $\overline{r} = 0.44$ to 0.55; text comprehension: $\overline{r} = 0.40$ to 0.61), whereas low correlations were found in the non-cognitive domain (rank-order components: interest in mathematics: $\overline{r} = 0.32$ to 0.37; interest in German language arts: $\overline{r} = 0.21$ to 0.30). The BiKS-8-18 data further revealed only low correlations between secondary school teachers' judgements of children's test anxiety (worry, emotionality) and children's self-reported test anxiety in the school subjects of German (worry: $\overline{r} = 0.28$, emotionality: $\overline{r} = 0.27$) and mathematics (worry: $\overline{r} = 0.44$, emotionality: $\overline{r} = 0.20$; Karing et al. 2015). Similar findings were reported by Zhu and Urhahne (2021) who investigated Chinese elementary school teachers' judgement accuracy of sixth graders' mathematical competence, motivation (e.g., self-efficacy, self-concept, effort, expectancy for success), test anxiety, and interest in the subject of mathematics. They found that teachers predict students' mathematical competence with high accuracy, motivation with moderate to high accuracy, and test anxiety as well as interest with low accuracy. These studies provide further evidence that diagnostic competence is not a unidimensional ability construct that encompasses both the cognitive and the non-cognitive domain. Thus, a general ability to assess student characteristics cannot be assumed (c.f. Kolovou et al. 2021).

1.3 Stability of Diagnostic Competence

As far as the stability of diagnostic competence over time is concerned, there has been almost no research so far. However, the notion of relative continuity and stability of judgement accuracy (related to a specific domain) is an important feature for the assumption of a trait-like concept like competence. Using the longitudinal BiKS-8-18 data, the stability of teachers' judgement accuracy could be examined (Lorenz 2011; Lorenz and Artelt 2009): For primary school teachers, moderately high correlations were found between two measurement points within a six-month interval for judgements in the areas of mathematics ($r_{t1t2}=0.38$/ $r_{t2t3}=0.44$)[1,2], vocabulary ($r_{t1t2}=0.57$/ $r_{t2t3}=0.49$)[1], text comprehension ($r_{t1t2}=0.51$/ $r_{t2t3}=0.47$)[1], joy of learning ($r_{t1t2}=0.42$), school attitude ($r_{t2t3}=0.47$)[1] and subject interest in language arts ($r_{t2t3}=0.40$)[1]. At least in the language domain, the stabilities are approximately at the same level as the judgement accuracies at the individual measurement points. The results offer some reason to assume that teachers' domain-related judgement accuracy can be considered as diagnostic competence. Recently, also Zhu and Urhahne (2021) reported a high stability of Chinese elementary school teachers' judgement accuracy of students' mathematical competence ($M_{t1}=0.70$ / $M_{t2}=0.74$), motivation (for different indicators: $M_{t1}=0.42$ to 0.65 / $M_{t2}=0.0.42$ to 0.61), test anxiety ($M_{t1}=0.28$ / $M_{t2}=0.16$), and interest in the subject of mathematics ($M_{t1}=0.33$ / $M_{t2}=0.35$) over a 4-week interval.

2 Explaining Inter-Individual Differences: Context and Teacher Effects

Throughout the literature, differences between teachers in the accuracy of their judgements are frequently reported (for an overview see Kaufmann 2020; Südkamp et al. 2012). Theoretical considerations and empirical findings suggest that inter-individual differences in the accuracy of teacher judgements of students' academic achievement can be explained by multiple characteristics of teachers, students, judgements, and tests (Südkamp et al. 2012).

In BiKS-8-18, characteristics of teachers, students, classes (i.e., context for social comparisons), and domain of the judgement (mathematics and reading) were examined as moderators of judgement accuracy. Although it is often

[1] r_{t1t2}: t1 = second half of third grade, t2 = first half of fourth grade for all available teachers (n = 125 for mathematics and n = 128 for vocabulary and text comprehension), r $_{t2t3}$: t2 = first half of fourth grade, t3 = second half of fourth grade for all available teachers (n = 118 for mathematics and n = 130 for vocabulary and text comprehension, n = 129 for joy of learning and interest in language arts and n = 129 for school attitude).

questioned whether judgement accuracy related to students' academic achievement can be regarded as a general ability such as diagnostic competence (e.g., Kolovou et al. 2021; Spinath 2005), theoretically it can still be justified that the accuracy of diagnostic judgements relates to certain teacher characteristics. Specifically, experience on the job and other variables related to teacher expertise (for results on relevant professional knowledge, see below) are potential candidates for such characteristics. For primary school teachers, Lorenz (2011) investigated the correlation between several teacher characteristics and their judgement accuracy. However, reliable correlations could not be found for any of these variables (professional experience [years on the job], gender, teaching time in the respective class, self-reported ability to perspective taking, attitudes towards and assessment of one's own diagnostic competence, striving for perfection, extent of further training). For the indicators of judgement accuracy used in the BiKS study (rank-order component, differentiation component, level component; see above), none of the teacher variables that were considered to be potentially influential made a difference.

However, there are further factors that are likely to impact teacher judgements. Referring to social cognition research and frame selection models, theoretically important student characteristics in this regard are personality traits, gender, immigration background or socio-economic status. It is argued, e.g., in the continuum model of impression formation (Fiske and Neuberg 1990) that people rely on social categories for judgement formation whenever possible, potentially leading to biased judgements. In this respect, a judgement is considered to be biased, if teachers systematically evaluate "two groups as differing on some criterion more or less than they really do differ" (Jussim et al. 1996, p. 329), based on variables that are irrelevant to the criterion. As for personality traits, Westphal et al.'s (2021) findings indicate that students' conscientiousness positively influences teacher judgement accuracy in mathematics. Bonefeld et al. (2020) found preservice teachers' judgements to be less favorable for students with (vs. without) immigration background and for female (vs. male) students in a virtual classroom setting. In the BiKS-8-18 study, primary school teacher judgements on students' competence in the domains of mathematics and vocabulary were also found to be significantly different depending on the students' gender. Student test performance, however, did not systematically differ between boys and girls, indicating a gender bias in teacher judgements (Lorenz and Artelt 2009). Lorenz (2011) was also able to show social disparities in primary education: students from the upper half of the distribution of socio-economic status (HISEI) were overestimated or underestimated to a lesser extent than students from the lower half of the social distribution. However, these gender-specific and social status-related differences in teacher judgements in the domain of reading could not be found in the BIKS-data for the teachers on secondary school level (Karing et al. 2011a, b).

Social status-related differences can also be interpreted in the light of similarity of habitus between teacher and student, indicating that a higher distance in social status between teacher and student might lead to lower expectations and teacher disaffection (e.g., Alexander et al. 1987). With this in mind, it also seems likely that also other aspects of similarity between students and teachers might play a role for the accuracy of teacher judgements. Rausch et al. (2016) showed that the similarity of personality traits between a student and their teacher can have a small, but significant influence on the accuracy of teacher judgements. For 168 teacher-student dyads in German language classes and 241 dyads in mathematics classes (each at the end of Grade 8), a similarity index between student and teacher was calculated for every student. Multiple regression models were run to map the judgement bias that can be attributed to personality similarity. Results indicate, that while students being more similar to their respective teacher did not show higher performance in the domains of mathematics and reading, the more similar students were judged more positively than students who were less similar. While this holds true for global judgements in both domains, this could not be replicated for task-specific judgements, where personality similarity did not have a significant impact on the judgement. One explanation could be that teachers focus more on individuating information about the students or on the task when conducting a task-specific judgement.

Not only individual characteristics of teachers and students—and their interaction—can play a role in the accuracy of judgements, but also characteristics aggregated at class level. The average performance level and the heterogeneity of the performance in the class were also considered to be theoretically significant factors influencing the judgement. High achievement heterogeneity in the class was found positively related to accuracy of teacher judgement in both primary and secondary schools (Karing 2009). Both high performance heterogeneity and a wide dispersion of subject interest led to a better discriminability of students with regard to these characteristics. This can have a facilitating effect for teachers (Karing 2009). Although these results may be also a statistical artefact because extreme values influence the correlation coefficients (e.g., rank component).

Considerable differences with regard to the heterogeneity of the performance in the class, teacher training, the class teacher principle vs. subject teacher principle, cooperation between teachers and cooperation with parents suggest that there are also differences between primary schools and secondary schools (Gymnasium) with regard to judgement accuracy. As compared to secondary school (Gymnasium) teachers, primary school teachers show higher accuracy in assessing student performance in the areas of mathematics (d = 0.60), vocabulary (d = 0.55), and text comprehension (d = 0.58), as well as subject-specific interest in German language arts (d = 0.30), but not in mathematics (d = 0.18) (Karing 2009). However, it is not possible to distinguish whether the effect is rooted in differences in the homogeneity of student achievement in classes (lower homogeneity in primary school classes; cf. Tillmann and Wischer 2006) and/or differences in teacher training between the two school forms.

3 Does the Accuracy of Teacher Judgements Affect Students' Learning?

The longitudinal design of the BiKS-8-18 study also made it possible to investigate the effects of teachers' judgement accuracy on students' competence development. Despite the high plausibility of the assumption of a positive correlation between the accuracy of judgements and the development of students' performance, only a few empirical studies have been conducted in this area (Anders et al. 2010; Behrmann and Souvignier 2013; Helmke and Schrader 1987; Karst et al. 2014; Urhahne 2015). In the BiKS research group, this question was examined again by investigating the effects of the accuracy of global and task-specific judgements on performance development in the competence areas of mathematics and text comprehension (Karing et al. 2011a, b). Longitudinal data were obtained from a sample of 502 students and their 40 German language teachers and 29 mathematics teachers (measurement points: at the end of grades 5 and 6). Nearly 80% of the students attended higher academic track schools. The multilevel analyses conducted for this purpose showed a significant positive effect of the task-specific hit rate on the students' development between the fifth and sixth grade of reading competence, but not on the development of the mathematical competence. In addition, the correlation was moderated by instructional variables such as teachers' use of structural cues (e.g., teacher summarizes the lessons that students can remember the gist) and the degree to which lessons were individualized. A high task-specific hit rate in combination with a high degree of individualization of lessons is related to an increased development in students' reading competence, whereas a high task-specific hit rate in combination with a low degree of individualization of lessons had no effect on the development of students' reading competence. Moreover, a high task-specific hit rate in combination with a low frequency of structural cue use during lessons is also associated with an increase in the development of students' reading competence. However, no association was found when structural cues were used frequently. One explanation for this unexpected result could be that because of their learning strategies and prerequisites, high-ability students rely more on self-directed learning and individualized instructions instead of being dependent on teachers' use of structural cues during lessons. However, for low-ability students a highly structured learning environment makes it easier for them to focus their attention on relevant aspects of the lessons and combine prior knowledge with new knowledge (Blumberg et al. 2004; Lipowsky 2009). Similar findings were reported by Möller et al. (2002). The authors interpret their findings in the sense that high-ability students did not require highly structured learning environments in science and social studies for their learning gains, while low-ability students profited more from a highly structured lesson.

For the rank-order component of judgement accuracy, no significant positive association or interactions between this indicator and any instructional variable were found in the domains of reading and mathematics. A possible explanation might be the low value of the rank-order component (reading: $\bar{r} = 0.19$, mathematics: $\bar{r} = 0.44$). Thus, no significant associations with the development of reading and mathematical competence could be identified. This corresponds with the assumption that a minimal degree of judgement accuracy and instructional quality is required for a significant relationship or interactions (Schrader 1989). Further, few studies reported that the effect of accurate teacher judgements on student achievement is moderated (e.g., Behrmann and Souvignier 2013; Karing et al. 2011b) or mediated (e.g., Anders et al. 2010) by instructional activities (e.g., frequent feedback, individualization of lessons).

4 Knowledge Base

Teacher judgements on student achievement are usually embedded in school subjects or even more specific fields of study within the respective subject domains. Within the BiKS-8-18 study, teacher judgement accuracy was also assessed related to specific subject or competence domains respectively. This also reflects the notion of a content-specificity of judgement accuracy (Kolovou et al. 2021). However, the open question remains, if, how, and to what extent teachers' domain-specific knowledge base affects the accuracy of teacher judgements in that very domain. From a theoretical point of view, it can be argued, that knowledge about the nature and demands of a domain are positively associated with accurate judgements of student performance (cf. Artelt 2016). This also implies that domain-specific cues need to be recognized and considered in the judgement process, to judge student performance effectively and accurately (cf. National Institute of Child Health and Human Development 2000). Using an additional sample of pre-service-teachers, teachers, and expert teachers within the BiKS-8-18 study, a knowledge test was developed in order to assess teachers' knowledge in the domain of reading. Individual student performance on a specific task is dependent not only on students' characteristics, such as their prior knowledge, intelligence, and motivation, but also on the quality and composition of materials (such as texts), demands of the (text-specific) tasks and the activities required by the student to perform the task (such as the use of reading strategies appropriate to the text and task demands (Campione and Armbruster 1985, see also Artelt et al. 2005). Specific teacher judgements on student performance in a given situation need to take into account all these aspects in order to deliver an accurate judgement. Therefore, the test aims at covering teachers' knowledge base on text and item difficulties as well as on cognitive processes of text comprehension. Thus, the test comprised the three dimensions of text characteristics, item characteristics, and (necessary) reading strategies. It was administered to teachers with German language arts as their main teaching subject. From these teachers ($n = 44$), global and task-specific assessments of individual student performance ($n = 233$ students) were also available. No significant correlations between teacher knowledge in the domain of reading (total test score as well as all subscores on text characteristics, task characteristics, and reading strategies) and the accuracy of student assessments on reading tasks (global and task-specific judgements) were found (Rausch et al. 2015). Other research for the domain of biology shows that pre-service teachers' professional knowledge was related to diagnostic activities but could not generally be related to diagnostic accuracy (Kramer et al. 2021). The results seem to indicate that while domain-specific knowledge might play a role in the judgement process, other more distal cues or heuristics might have more impact on judgement accuracy (see research on influence of gender or immigration status on judgement accuracy, e.g., Bonefeld et al. 2020). The BiKS study was able to contribute to the research body on how teachers' domain-specific knowledge influences judgement processes and thus judgement accuracy. In the context of judgement processes in educational settings, it remains an open question, what elements of teacher knowledge are crucial in the judgement process, and how these domain-specific aspects are overlayed for example by (simple) heuristics in concrete judgement situations.

5 Summary and Outlook

Our research was dedicated to questions on judgement accuracy of teachers at primary and secondary level. Especially through the recording of diagnostic competence over several measurement points as well as through the broad recording of cognitive and emotional-motivational variables and the corresponding teacher assessments, contributions could be made to the further scientific clarification of conditions, structure and effects of diagnostic competence. New insights were also gained with the development of a test on teachers' knowledge bases in the area of text comprehension.

Primary school teachers are relatively good at assessing student performance in the performance areas, whereas they find it much more difficult to correctly assess students' subject interest. In contrast, teacher judgements in lower secondary school show rather low correlations with students' reading competence, both in global and in task-specific judgements. Global judgements are more accurate than task-specific judgements. For task-specific judgements, it can be seen that German language teachers accurately assess the dispersion of reading competence, while on average they overestimate the level of reading competence.

With regard to the structure of diagnostic competence, it could be shown in our studies that it is a subject-related ability that is relatively persistent over time. On the other hand, a general ability to assess students' characteristics across subject areas cannot be assumed. Likewise, it is not a homogeneous construct in the sense of a competence that is evident across the different judgement components.

Our results also show that the repeatedly reported large inter-individual differences in the accuracy of judgements between teachers can be attributed to a complex set of conditions consisting of characteristics of the teacher, the students, the class and the subject of judgement. Influencing factors in primary education are primarily to be found at class and student level. The dispersion of performance in the class has a considerable influence on the accuracy of judgements, as does gender and the students' social status. This correlation—an indication of bias—was not found for teachers at the secondary level.

Furthermore, there is a positive correlation between the task-specific hit rate and the development of reading competence in lower secondary school. This is particularly evident when the degree of individualization of instruction is high and when fewer structuring aids are offered in the classroom.

For the work related to teachers' knowledge base for judgements in the area of text comprehension, it can be summarized that we did find differences between more or less experienced teachers, but not for all task formats. If there were differences, they were mostly in favor of experts who scored more positively. In accordance with the question about the connection between knowledge and accurate assessments, it should be noted that we did not find any significant correlations, i.e., there is no connection on the basis of different components.

We also found that teacher judgement accuracy varies as a function of the respective achievement/competence domain under study (e.g., students' mathematical or reading competence, see Artelt and Rausch 2014 for a discussion), between competence and motivational characteristics of students (see also Spinath 2005) and—to some degree—as a function of features and demands of the judgement process. However, there is also reason to assume that there is a latent trait (or disposition) rooted in professional knowledge and expertise. As such, assessment competence is regarded as a learnable and situation-specific disposition (c.f. Herppich et al. 2018) and judgement accuracy is only a quantifiable product of this disposition.

To further elaborate on this, theories and research systematically need to consider the role of contextual factors like judgement purposes and demands. As demonstrated by Herppich et al. (2018), models need to integrate research on assessment processes, practices, and products.

Rooted in Rosenthal and Jacobson's (1968) much-cited work on expectancy effects, research not only focused the effects of non-accurate (but rather positive) teacher judgements, assuming that they impact teachers' learning fostering behavior and feedback (e.g., Gentrup et al. 2020). However, being accurate or overestimating students seems to follow different functions. Whereas accuracy seems to be important for formative assessments, since students profit most from receiving accurate feedback on their actual performance, including mistakes, (unrealistic) positive judgements operate on students' motivation and self- concept and might thereby foster learning. Further, Urhahne and Wijnia (2021) already criticized in their review on teachers' judgement accuracy that the majority of the studies investigated judgement accuracy only at one measurement point. Thus, the BiKS-8-18 panel data is unique in undertaking longitudinal measurements of teachers' judgements and students' performance. It allowed us to study the effects of teacher judgement accuracy on students' progress over the course of different school years in different cognitive and emotional-motivational domains. Hence, future research should use longitudinal designs to investigate teacher judgement accuracy in order to draw more robust conclusions, e.g., on the effects of judgement accuracy on student performance or on aspects of professional development of teachers' diagnostic competence from teacher education to the classroom. The findings can also inform teacher education, especially in subject-related didactics.

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Educational Disparities Before and After the Transition from Primary to Secondary School in Germany: BiKS-8-18 Results on Differences in Children's School Outcomes and Decision-Making Processes

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Abstract

Using data from BiKS-8-18 longitudinal cohort from Bavaria and Hesse, BiKS Project 5 focused on analyzing disparate educational trajectories and outcomes among students 8-18 years old. Applying Boudon's (1974) theoretical distinction between primary and secondary effects of social origin, this chapter

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summarizes the results of the influence of social origin, social relations, and intra- and extrafamilial support on different dimensions of success at school, including competencies, grades, and school self-concept. The empirical findings demonstrate the centrality of intra-family and family-school relationships before and even after the transition to secondary school and the limited opportunities in Germany to correct earlier educational decisions in secondary school. The project also involved investigating the educational decision-making processes of parents (and older students) from different social backgrounds and teachers before and after the transition from primary to secondary school to shed light on Boudon's secondary effects of social origin. In particular, the dynamic impacts of parental aspirations and the family's social capital, educational costs, and probabilities of success on early tracking decisions were examined and proved to be relevant, albeit not for all social groups and situations.

Keywords

School transition · Family background · Family aspirations · Family social networks · Institutional differences

1 Objectives and Research Questions of BiKS Project 5

International comparative studies have shown that educational disparities according to social background remain quite common in all industrial societies (Baumert et al. 2001; Blossfeld et al. 2016a, 2016b; Breen and Müller 2020; Bukodi et al. 2018; Erikson and Jonsson 1996; Shavit and Blossfeld 1993). In those cross-national comparisons, the German education system is often characterized as a particularly unequal institution owing to its early tracking and strong stratification—students as young as 10–12 years old are assigned to different types of secondary schools, namely 'Hauptschule,' 'Realschule,' and 'Gymnasium'—which make early educational choices difficult to revise (Blossfeld et al. 2016b). Although disparities in educational opportunities among children from different social backgrounds in Germany have decreased somewhat in recent decades, substantial inequalities in educational opportunities by social background persist (Becker 2009; Blossfeld et al. 2015, 2020; Breen and Müller 2020; Henz and Maas 1995; Krais 1996; Müller 1998; Müller and Haun 1994; Schimpl-Neimanns

2000). Moreover, despite increasing permeability between types of schools and greater opportunities to catch up in educational attainment later in one's school career, secondary schools in Germany continue to be characterized by a relatively high degree of stratification (Blossfeld 2018; Zielonka 2017).

Another distinctive feature of the German educational system is the so-called cultural sovereignty of the federal states ('Kulturhoheit der Länder'), which gives federal states in Germany ('Bundesländer') responsibility for the legislation, organization, and administration of schools and universities within their borders. That arrangement has prompted the implementation of different institutional arrangements and structures in the German school system, the consequences of which have been documented in various PISA studies. Indeed, such research shows that educational participation in secondary schools and the distribution of students' competencies at the age of 15 years differ substantially between Germany's federal states (Baumert et al. 2002; von Below 2002).

In BiKS Project 5, special attention was paid to students' primary school years, transitions to secondary school, and academic careers thereafter. In those early years of schooling, basic competencies are acquired that form the basis for the acquisition of knowledge in later years of education and constitute the foundation for parents' decisions about their children's education.

Boudon's (1974) distinction of primary and secondary effects illuminates the interplay of social origins and competencies as well as educational decisions. Whereas *primary effects* refer to differences in competence levels that stem from different environments of socialization in and around the family (Becker 2007), *secondary effects* refer to differences arising from different (i.e., parents' or students') educational decisions, even if the students' competence levels are basically the same. Parents' (and students') decision-making is seen as the result of cost-benefit calculations at particular educational transitions that vary by social class (Becker 2000; Boudon 1974; Breen and Goldthorpe 1997).

The first research goal of BiKS Project 5 was to examine the impact of social origin on achievement at school. In particular, the influence of social relations and intra- and extrafamilial school support on success at school was studied, measured in terms of not only children's grades and competencies but also their self-concept, which needs to be strong enough to support motivated learning and is thus a central parameter for achievement at school (Köller and Möller 2006; Satow and Schwarzer 2003). The three following research questions were thus addressed by BiKS Project 5:

1. Do social relations within and outside the family have an additional influence on relevant dimensions of school success before and after the transition to secondary school?
2. Can differential effects of social relations be observed depending on social background?
3. How effective are home tutoring and privately paid tutoring in primary school, and to what extent do families from different social backgrounds use such forms of tutoring ?

The second research goal of BiKS Project 5 was to subsequently examine the process of parents' decision-making about their children's education shortly before and after their children's transition from primary to secondary school. Given the early age (i.e., 9–11 years) of students at that first important school transition, the choice of secondary school depends heavily on parental decisions. To gain insights into parents' decision-making, we applied the concept of *parental aspirations*, meaning parents' aspirations for their children's education. When realistic, parental aspirations can be interpreted as predictions of possible educational pathways or high education attainment given a child's demonstrated competencies in primary school (Becker 2000). Such aspirations are influenced by a child's perceived chances of attaining a specific degree, as well as by cost-benefit considerations regarding different academic trajectories (Haller 1968). Thus, on the topic of such decision-making and aspirations, the following research questions were also addressed in BiKS Project 5:

4. How do parental aspirations shape their decision-making processes as their children transition from primary to secondary school?
5. To what extent do different school institutions in different federal states ('Bundesländer') influence parental aspirations, and what is the importance of teacher recommendations in different states?
6. How is the transition from primary to secondary school shaped by social background, and to what extent are decisions concerning which type of secondary school to attend later maintained or revised in secondary school?

The project relied on school-level data from the longitudinal BiKS study 8-18. For primary school, data were available for three measurement points from the middle of Grade 3 to the middle of Grade 4. For secondary school, data were collected from Grade 5 to Grade 9 each year. Thanks to the panel design of the BiKS study and its stratified sample (i.e., students in classes), the data enabled a multilevel and longitudinal analysis, which subsequently facilitated the modeling of processes involved in the development of grades, competencies, and self-concept throughout students' academic careers and their parents' decision-making processes regarding secondary school and transitions therein. Moreover, because the BiKS study 8-18 covered both Bavaria and Hesse, data were available from two German states whose transition rules differ greatly and thus represent various opportunity structures for parents and students (cf. Kurz et al. 2007). The comparison of school transitions in Bavaria and Hesse is extremely interesting from a theoretical point of view.

At the end of the chapter, we briefly discuss the implications of the project's findings and, in turn, what we recommend for policy.

2 Influence of Social Relations and Intra- and Extrafamilial School Support on Children's Success at School

Influence of Social Relations on Success at School

Empirical research has repeatedly shown that origin-specific educational inequalities are rather persistent in Germany. On the basis of the longitudinal BiKS study 8-18 and using a statistical decomposition model to differentiate primary and secondary effects, Relikowski et al. (2010) found that the primary effects of social origin in primary school are strong. Moreover, regarding social capital, BiKS Project 5 has revealed that children from educationally disadvantaged households have less educational opportunity than children from households with higher educational backgrounds (Kleine 2014). Given those primary effects, the influence of social capital constituted a primary focus of BiKS Project 5. The influences of social relations are particularly important for success at school, given their status as additive and independent explanatory factors in statistical models. Beyond that, arguing that social capital is embedded within social relations between different actors, Coleman (1988, 1992) distinguishes social capital within the family from social capital within the family's environment. That is, social capital is not necessarily connected to a family's economic resources or human capital, and parents and children in educationally deprived classes can indeed develop relationships with individuals outside the family with higher human capital. As a result, children from relatively disadvantaged backgrounds can compensate for human capital deficits within their families by establishing contacts with actors outside the family. Meanwhile, concerning social capital within the family, Coleman underscores that children from families with privileged social background profit much more from strong, close social relationships within their families, because parents with higher human capital transfer to their children the (positive) experiences with education that they enjoyed themselves and their knowledge about the educational system. However, parents with lower human capital cannot draw on those resources.

Studying the importance of social relations for educational success, BiKS Project 5 used grade point averages (Kleine 2014; Schmitt 2012, 2014), grade levels (Luplow 2017; Schmitt and Kleine 2010; Schmitt 2012), school competencies (Luplow 2017; Schmitt 2014), and, as a key determinant of achievement at school, school self-concept (Kleine et al. 2013; Schmitt 2012). The results of BiKS Project 5 confirm hypotheses derived from the theoretical assumptions of Coleman's social capital approach and can be summarized as follows. First, intra-school social capital, in the sense of high-quality relationships among students and between students and teachers, is closely related to academic success (Kleine 2014; Schmitt 2012, 2014; Schmitt and Kleine 2010). While BiKS Project 5 showed that intensifying the relationships with their classmates and teachers before the transition has no additional effect on performance growth (Schmitt 2012), changes in those relevant relationships are associated with the adjustment of a child's school self-concept (Kleine 2014; Kleine et al. 2013; Schmitt 2012). Relationships with teachers are especially important for students in the intermediate vocational track—that is, Realschule (Schmitt 2014). Those findings underscore the importance of social relationship structures within the school for optimal learning. In addition, the ambitious educational goals of friends can positively affect a student's success at school, which stresses the significance of shared values and norms for success at school (Kleine 2014; Schmitt 2012; Schmitt and Kleine 2010). Even after the transition to secondary school, it is especially important for students in the low academic track to be surrounded by friends with high aspirations (Schmitt 2014). In addition, BiKS Project 5 showed that school-relevant information and performance-enhancing knowledge can also be communicated via frequent parent-teacher contacts in primary school (Kleine 2014; Schmitt 2012; Schmitt and Kleine 2010). At a certain point, however, there is a negative correlation between the number of conversations between parents and teachers and grades (Kleine 2014). On that count, performance- or behavior-related problems seem to be the reason for more frequent contact and hence the observed effect.

A statistically significant influence of intrafamily social capital on children's success at school was also found in BiKS Project 5. Both the structural and procedural features of a close parent-child relationship have a statistically significant independent influence on success at school. Furthermore, both indicators of school interaction and indicators that reflect everyday family life are shown to have explanatory power (Schmitt 2009, 2012). In addition, parents' high idealistic aspirations for their children's education, conceived as aspirations that do not take into account students' achievement at school, are associated with success in school and the child's school self-concept. It was hypothesized that more ambitious aspirations among parents affect their children's learning success by increasing school support (Coleman 1992), particularly for parents with high educational attainment, whose higher human capital makes them more effective in translating their goals for their children's education into concrete support (Kleine 2014; Schmitt 2012, 2014). Last, a differential effect has also been found for a more mundane aspect of intra-family relationships. Even when both groups feel respected, children with highly educated parents show a higher self-concept than children with parents with low education and thus seem to benefit more from their parental human capital (Kleine 2014).

The Impact of Intra- and Extra-Familial Support with School
Another research objective of BiKS Project 5 concerned family processes as an aspect of class-specific socialization that leads to differences in competence levels. On that topic, the project specifically focused on school-related family support processes (Luplow 2017) that parents can provide in the form of frequent support with homework or frequent additional (intra-familial) practice during homework. However, parents may also outsource support in the form of (extra-familial) paid tutoring. Assistance with homework and private tutoring are rational strategies by which parents can actively influence their children's educational competence and ensure a transition to more challenging secondary schools. In that regard, BiKS Project 5 examined the extent to which parental support mediates family background and a child's educational development. To that end, Eccles and Wigfield's (2002) extended expectancy-value approach was followed to explain educational success as a result of intra- and extra-familial processes while also taking determinants of rational choice into account (Esser 1999). BiKS Project 5 additionally involved analyzing how parental and extra-familial support in the form of institutional tutoring affect children's grades and competencies, as well as teachers' recommendations and their actual transitions to secondary school. Along with the expectancy and value components that rational choice theory identifies as being crucial for decisions, Eccles and colleagues have included (socio-)psychological mediating factors such as self-concept and motives that are thought to influence decisions and school performance (Eccles et al. 1983; Jonkmann et al. 2010; Wigfield and Eccles 2000).

Social background has repeatedly been shown to positively influence students' grades at school and linguistic competence (Baumert and Schümer 2001; Baumert et al. 2006; Bos et al. 2007; Schauenberg 2007; Schwippert et al. 2003).

On that count, BiKS Project 5 revealed that assistance with homework and extra practice are widespread phenomena in families. The project's descriptive results showed that half of the parents of students in Grade 4 reported frequently helping them with homework, while just under half reported frequently spending time giving them additional practice. At the same time, support can also be outsourced from families. While only 5% of the students received German-language tutoring, slightly less than 7% received math tutoring.

Unsurprisingly, whether students receive support depends on their performance in school. The worse their grades, the more often they are supported at home and receive tutoring. Also, when students show relatively poor performance in school and such performance may be reported to parents by their teachers, support at home tends to increase. In fact, parents are more sensitive to any change in performance in school than to the general level of performance itself.

In BiKS Project 5, we expected that social background would impact family support. However, our findings showed that social background did not play a major role in the use of tutoring. In the case of home learning, more highly educated parents tended to hold back and relied more on home learning only when their children's grades worsened.

A mediating factor was parents' perceived control beliefs, which were related to their decisions to support their children or seek external support if they themselves did not have a higher school degree. For parents with so-called Abitur (i.e., the general qualification for university entrance in Germany and the highest degree possible), control beliefs do not play any role. If highly educated parents want the Abitur for their children, then they become home-based supporters. By contrast, idealistic aspirations for the Abitur have no relevance for the use of private tutoring.

As for central (socio-)psychological mediators, we also examined children's school self-concept and ability to manage homework. Children's self-concept from their parents' perspective influences family support only if the parents perceive their children's self-concept to be high and if they themselves have also attained a degree in higher education. In that case, they hold back on home learning. The assessment of homework completion emerged as a clear predictor of both tutoring and parental support. If parents deemed their children's completion of homework as an independent task and not requiring their particular help, then those students received less tutoring and less help from their parents overall regardless of their parents' level of education.

According to rational choice theory, parents use domestic and institutional help strategically to prevent downward intergenerational mobility within the family. Both help with homework and extra practice, as well as tutoring, were more likely to be exercised by highly educated parents if they cared about the prestige of their child's future profession. Thus, status maintenance seemed to be a key variable in decisions for parents with Abitur to give their children such forms of support. Beyond that, however, it was impossible to calculate separate models according to educational background for tutoring due to the low number of cases.

In contrast to our expectations regarding rational decision-making, financial costs were not a strong factor in parents' decisions to provide their children with educational support. Thus, monthly household income did not show any influence on the use of tutoring.

Another key research question of BiKS Project 5 addressed the effectiveness of different forms of support. Support with homework had no effect on grades at the end of Grade 4, the teacher's recommendation for upper secondary school (i.e., Gymnasium), or the actual transition to that track. However, additional practice tended to be negatively related to grades and the teacher's recommendation.

In agreement with findings from other longitudinal studies (Guill and Bonsen 2011; Guill and Bos 2014; Hosenfeld 2011), BiKS Project 5 did not reveal any differences in the gaining of skills between students who received tutoring versus those who did not. In that respect, disadvantages can even be found in grades in German and math, as well as in teachers' recommendations for higher school tracks. For the actual transition, however, no differences could be observed. The disadvantage for students who received tutoring may have several causes. For one, because there were no differences in gains in skills, only in grades, the differences in grades could be due to teachers' evaluations. For another, tutoring seemed to signal students' deficits and problems to teachers, which may have affected their assessment.

3 Parental Aspirations, Educational Decisions, and Children's Trajectories in School

Parental Aspirations and the Choice of Different Types of Secondary Schools
BiKS Project 5 also involved investigating parents' decision-making about their children's education shortly before their children transition from primary to secondary school. Early educational transitions are more dependent on parents than later ones. For this reason, parents are treated as central actors in the empirical analyses. Of course, parents' choices about their children's education are essentially tied to their children's performance in school because they constitute an important predictor of later success in school, later education costs, and expected benefits of degrees.

To explain parents' aspirations and decisions concerning their children's education, BiKS Project 5 first followed a rational choice approach (Esser 1999) before comparing the empirical results in light of an alternative theoretical interpretation: the Wisconsin sociocultural approach (Sewell et al. 1969, 1970). According to rational choice theory, all parents are assumed to have similar preferences for their children. However, based on their class-specific (i.e., economic and social) constraints, they evaluate different school degrees differently in terms of their expected costs and benefits. Per the theory, they thus choose the educational pathways for their children that maximize the expected returns (Breen and Goldthorpe 1997; Erikson and Jonsson 1996).

By contrast, the Wisconsin sociocultural approach views families' educational decisions as being guided by class-specific values and norms (Sewell et al. 1969, 1970). Thus, parents in different social classes are assumed to have different, largely unconscious, but stable class-specific aspirations regarding their children's highest level of education attainable (Gambetta 1996). This implies, of course, that parental aspirations should be rather constant across the child's academic career.

In BiKS Project 5, the theoretical predictions of those two competing models were tested with a longitudinal approach (Kleine 2014; Kleine et al. 2009). First, it was found that a large proportion of parents adjusted their preferences for their children's graduation when their children's academic performance changed. A change in financial costs also seemed to be an important reason for the adjustment of parental aspirations. Parents considered financial costs to be more important if they had low educational attainment, whereas better-educated parents considered them to be relatively unimportant. Last, greater perceived benefits of degrees in higher education influenced parents' decisions between intermediate secondary school (i.e., Realschule) and upper secondary school (i.e., Gymnasium) in favor of the more demanding 'Gymnasium'. The results of BiKS Project 5 also showed strong group-specific differences in the stability and variability of realistic parental aspirations for their children (Kleine et al. 2009). Not only did parents with high levels of education show higher aspirations for their children than ones with low levels of education, but those aspirations were also more stable in their decision-making over time. Thus, even when children have comparable academic performance, parents with higher levels of education want higher degrees of education for their children. In rational choice theory, that phenomenon is known as the "secondary effect of social origin" (Boudon 1974). The fact that highly educated parents keep their parental aspirations stable in the relevant phase of decision-making when their children are in Grades 3 and 4 instead of adjusting them to their children's actual achievement in school does not seem to be the result of different sociocultural values, as the Wisconsin sociocultural model claims, but instead driven by differences in the perceived attainability of high levels of education and the so-called status maintenance motive of highly educated parents (Becker 2000; Breen and Goldthorpe 1997). Better-educated parents simply know the school system better, have more opportunities to support their children financially and in providing parental support in learning, and are therefore more likely to maintain their original (i.e., higher) parental aspirations. They are also more likely to resist teachers' recommendations that do not support the goals that they have set for their children (Kleine 2014; Zielonka et al. 2014).

Following the Wisconsin sociocultural approach, the influences of reference groups were also investigated in detail for significant others in BiKS Project 5 (Kleine 2014). The empirical results showed that parents perceive the educational aspirations of their children's classmates' parents as important and incorporate them into their aspirations for their own children. Thus, this indeed underscores the importance of adopting educational group norms (Kleine 2014).

The analyses of BiKS Project 5 further demonstrated that parents with daughters have higher aspirations than those with sons. Their decision between lower secondary school (i.e., Hauptschule) and intermediate secondary school (i.e., Realschule) is more likely to be made in favor of the latter if daughters are concerned, assuming equal grades between sons and daughters (Kleine 2014). One explanation could be that especially non-cognitive differences perceived by parents (e.g., greater diligence, more self-discipline) influence parents' decisions in favor of girls.

Parents with migration background exhibit specific behavior as their children transition from primary to secondary school (see Blossfeld and Nester this volume). Their expectations for their children's education are systematically higher than those of native parents with the same level of education, especially when children's achievement-related disadvantages (i.e., due to greater deficits in German-language skills) are controlled for in the statistical analysis. Even if parents' expectations concerning their children's education decrease in the decision-making phase and thus become more realistic regarding their children's actual performance, they still exceed the aspirations of native parents (Blossfeld and Nester this volume; Kleine 2014). That impact can be interpreted as a positive "secondary effect of ethnicity" (Kristen and Dollmann 2009). In the transition to secondary school, children with migration background thus have an advantage over other children with the same performance in school and are more likely to advance to types of schools that confer qualifications needed for higher education (Zielonka et al. 2013).

In BiKS Project 5, particular attention was also paid to the state-specific opportunity structures in Hesse and Bavaria (Kleine et al. 2010). In Bavaria, the transition from primary to secondary school is tied to a relatively strict recommendation from the teacher based on the child's grades in a few core subjects that is difficult for parents to circumvent. By contrast, parents in Hesse are not as bound by teachers' recommendations and can choose the type of school for their children with relative freedom (Bellenberg et al. 2004). In Hesse, the decision regarding what type of secondary school to send a child to can be postponed, sometimes by several years, because Hesse offers not only the Hauptschule, Realschule, and Gymnasium but also the integrated comprehensive school ('integrierte Gesamtschule') and cooperative comprehensive school ('kooperative Gesamtschule'). With the integrated comprehensive school as an option, parents do not have to immediately decide the type of school for their children (i.e., Hauptschule, Realschule, or Gymnasium) when primary school ends (i.e., end of Grade 4). Instead, that decision can be shifted to when their children are older depending on the children's academic performance in basic and advanced courses. In the cooperative comprehensive school, by comparison, the respective class conferences of the schools decide at the end of Grade 6 whether a child will be transferred to a specific school track. The analyses of Kleine et al. (2010) have also indicated that Hesse's more open, permeable school system offers better opportunities for obtaining degrees in higher education than Bavaria's relatively rigid one. In Hesse, more teachers' recommendations for higher types of school were also given. Thus, in Hesse, when children demonstrated academic performance similar to their peers in Bavaria, not only parents' expectations of their success in school but also teachers' recommendations were geared towards higher educational attainment. Looking at the graduation rates predicted by the Standing Conference of the Ministers of Education and Cultural Affairs of the federal states ('Kultusministerkonferenz der Länder') in Germany (Sekretariat der Ständigen Konferenz der Kultusminister der Länder in der Bundesrepublik Deutschland 2007), those expectations and recommendations are also more promising. In Bavaria, by contrast, parents link their expectations for their children's graduation more closely to their children's academic performance in primary school, and teachers' recommendations more often direct students towards lower and intermediate secondary schools.

In general, parents revealed different decision-making patterns in answering what was clearly not an either-or question. Whereas some parents were deliberative and calculated and changed their aspirations for their children over time depending on their academic performance, others had a static aspiration for their child across their academic career. In these situations parents' educational background and the institutional regulations of the education systems in the federal states played important roles. Hesse gives parents greater freedom to maintain their aspirations, even if their children's grades or teachers' recommendations contradict those aspirations. As a rule, parents from educationally advantaged backgrounds are more likely to uphold their aspirations; compared with parents from educationally disadvantaged backgrounds, they usually know the school system well and have ample opportunities to support their children throughout their academic careers (Kleine et al. 2009).

Transition Behavior and School Trajectories during Secondary School
Despite frequent public discussions about the increasing permeability of the German school system, the transition from primary to secondary school remains the central branching point in children's academic careers in Germany, careers that further develop in secondary school. The way in which parents navigate institutional rules and consequences for students in secondary school were also analyzed in BiKS Project 5 for both Hesse and Bavaria (Zielonka 2017; Zielonka et al. 2014). Established as well as innovative theoretical models were used to develop hypotheses about the revision or stabilization of decisions about school choice after the transition to secondary school (Zielonka 2017).

BiKS Project 5 showed that for transitions within the secondary school system, state-specific regulatory differences are also important. In Bavaria, for example, grade boundaries remain in place after transitions to higher secondary school tracks. In Hesse, by contrast, a change occurs in the decision-makers; there, not the parents but the class conference of secondary school teachers decides, following a parent's request, whether their child's transition to a higher track in secondary school is reasonable and possible. At the same time, in both federal states moving to a lower secondary school track is always possible on a voluntary basis and even becomes obligatory for students after a grade is repeated twice.

How parents and students use differences within the institutional framework for revising their choice of secondary school becomes clear by examining the trajectories of those students from BiKS-8-18 who changed the type of school at least once. Such changes are similarly frequent in both federal states, while certain differences are important. In Hesse, changes to other non-tracked types of schools (e.g., comprehensive schools) are very common, especially between the first and second half of the school year. In Bavaria, however, (upward) transfers from the Hauptschule dominate, and such changes mostly occur in the summer between school years.

The question then arises as to whether and how selective school progressions are and which factors are important in that process. In examining decisions of school choice and trajectories in secondary school, we again applied Boudon's (1974) distinction between primary (i.e., performance-related) and secondary (i.e., decision-related) effects of social origin.

The analyses of BiKS Project 5 revealed social differences in Bavaria and Hesse, especially when the Hauptschule was chosen as the initial type of school after primary school. Thus, children from educationally advantaged families in Bavaria more often advanced from Hauptschule to higher tracks (e.g., Realschule or Gymnasium). Conversely, students from less-educated families tended to drop out of Gymnasium more often, even after controlling for performance in school, age, and the initial type of secondary school. Children from better-educated families also had a higher propensity to move from lower secondary (i.e., Hauptschule) to intermediate and/or upper secondary school types or to keep their position in the intermediate secondary school (i.e., Realschule) and the upper secondary school (i.e., Gymnasium). Put differently, BiKS Project 5 revealed a clear secondary effect of social origin.

Again, a number of theoretical explanations for those secondary effects have been suggested, mostly stemming from the rational choice framework (Becker 2000; Breen and Goldthorpe 1997; Erikson and Jonsson 1996; Esser 1999). Added to that, ideas about the effect of class-related aspirations (Sewell et al. 1969, 1970) and the role of social and cultural capital have been examined (Bourdieu 1982; Bourdieu and Passeron 1971; Coleman 1988). In an attempt to overcome the limitations of rational decision theories and as a bridge to other theoretical approaches, a relatively recent adaptation of the frame selection theory for concrete education-related decisions (Esser 2005; Kroneberg 2005; Stocké 2013) was tested in the empirical analyses of BiKS Project 5 (Zielonka 2017). In addition, to better account for the dynamic nature of school trajectories, theoretical concepts from research on the life course (Blossfeld and Shavit 1993; Müller and Karle 1993) were used.

In the empirical analysis, the subjectively assessed probability of success proved to be highly important for moves between secondary schools in either direction (Zielonka 2017). Cost-related factors attached to potential types of schools or changes to other tracks in secondary school were not statistically significant, contrary to the suggestions of Breen and Goldthorpe's (1997) model and as suspected by Erikson and Jonsson (1996). The probability assessment of being able to maintain or improve one's own status, as proposed by Esser (1999), was also of little relevance when considered on its own. On top of that, the difference in the subjective utility between a child's current type of school and their targeted type predicted socially selective mobility behavior less well than differences in subjectively determined probabilities of success. A change in the relevance of factors related to rational choice among parents and children over the course of secondary education, as expected by the life course perspective, could be empirically detected for downward movements in school and the perspective of students. It appears that the expected probabilities of success perceived by students for moves to less prestigious types of schools increase in importance. Thus, parents as well as children seem to be significantly driven in their decisions by what is possible and less by what seems to be desirable or sufficient from a rational actor's perspective, given their own resources or starting position. Coleman's (1988) theoretical claims about the social capital of the family, operationalized here in terms of social relations to and activities in school, played a substantial role only in the avoidance of relegation.

The idealistic aspiration, by contrast, which is somewhat independent of a student's current academic performance and prospects for success, turns out to be a stable predictor of mobility behavior even when performance in school is controlled for. That finding supports the ideas of the Wisconsin model that such aspirations create a status-dependent cultural or normative target space for educational decisions. Particularly for parents and for the sake of potential upward mobility, the analyses of BiKS Project 5 suggest that their importance even increases during secondary school.

Those findings indicate the simultaneous applicability of two explanatory models: the rational choice model, focusing on the costs and benefits of educational options, and the normative model, referring to class-specific values related to social networks. Thus, decisions about children's education in secondary school can be explained by different action logics and modes of decision-making. Depending on the decision-making situation, actors switch between automatically spontaneous versus well-considered rational action modes, as discussed in the model of frame selection (Esser 2005; Kroneberg 2005; Stocké 2013). Thus, the analyses of BiKS Project 5 suggest two temporally and mutually exclusive but complementary explanatory modes of decision-making applied in different situations. On that topic, Zielonka (2017) has empirically shown that the activation of a specific decision-making mode can moderate central explanatory factors (i.e., rational vs. normative). The model of frame selection was also supported by empirical evidence showing that ideal aspirations are significantly influenced by the social frame of reference and, contrary to the basic assumption of the Wisconsin school, are not independent but negatively related to the development of performance in secondary school. Thus, the importance of children's performance to the change in parental aspirations and the aspirations of children and adolescents also depends on the homogeneity and strength of the aspiration frame, which is ultimately consistent with the predictions of the frame selection model for decisions about education. If there is a homogeneously high aspiration for a child among significant others in parents' lives, then the child's poorer performance in school will lead to a smaller reduction in the parent's aspiration than when aspirations in the social environment are more heterogeneous, less clear-cut, or even absent. Similar moderating patterns can be found for the ideal graduation-related goals of children's friends on the achievement-related variance of their own aspirations. As for mode selection, the moderating effects of the ideal aspirations of parents' significant others could be demonstrated at least for students in upper secondary school ('Gymnasium') and intermediate secondary school ('Realschule'). Moreover, the fit of the child's or adolescent's personal situation within a social context also seems to influence how changed performance in school impacts the selection of a rational or automatic spontaneous mode. The same changes in performance lead to corresponding thoughts about upward or downward mobility between types of school later or less frequently among parents if the type of school in the environment and the school type currently attended—and hence the desired degree—by the child are the same. In turn, that dynamic, in combination with the demonstrably moderating effects of a more automatic spontaneous mode, is likely to enhance the impact of normative social framings. It also suggests that this type of integrative theory offers a relatively coherent explanation for the observed persistence of normative aspects in decisions about education, even in secondary school.

4 Theoretical Implications and Recommendations for Policy

Theoretical Implications

BiKS Project 5 has provided many important descriptive findings and involved the testing of established as well as innovative explanations for disparate school trajectories and their outcomes in light of social background.

We have observed a lack of studies in Germany on how social relationships impact achievement at school. BiKS Project 5 revealed that Coleman's (1988) theoretical model can also be applied to Germany's stratified school system by taking into account origin-specific modes of action. We were also able to demonstrate that the change in the perceived quality of relationships is associated with a change in school self-concept. Last, implementing an extended expectancy-value model to explain social differences in intra- and extrafamilial school support enabled us to link important sociological and psychological concepts (e.g., socioeconomic background, status maintenance, self-concept and motives). BiKS Project

5 additionally showed that the same decision parameters are important for all parents, independent of their level of education. Although the likelihood of receiving different forms of support regarding social background is similar, there are clear origin-specific differences in the motives and expectations regarding forms of support.

Theoretical approaches explaining educational decisions refer either to educational aspirations shaped by the origin-specific social environment or to origin-specific individual (e.g., economic or social) constraints that lead to different cost-benefit considerations. In the past, the dynamic interdependences of those two models and performance in school remained quite opaque. With the help of the longitudinal BiKS-8-18 data, we were able to demonstrate that most parents' aspirations for their children to graduate changed. Moreover, parents' decisions also depended on interpersonal influences, which lead to the adoption of parental aspirations shared by the social origin group. At the same time, the assumption that parents reevaluate the probability of their child's achieving Abitur due to a change in the parameters of academic performance and thus the probability of success, as well as anticipated temporal and financial costs, was empirically supported. Thus, BiKS Project 5 generated empirical evidence of the validity of both theoretical approaches, the influence of social relations, and rational choice theory. Thus, in theoretical terms, the situation does not present an either-or choice. Whereas some parents tended to take a more deliberative, calculated approach, others tended to make their decisions at a relatively early age.

BiKS Project 5 also showed that both the institutional requirements of the education system and parents' educational background interact and play a major role in decisions about their children's education.

Based on testing the competing theoretical explanations in secondary school, the results showed that parents were again driven in their decisions by what was possible given their children's academic performance and the resources of their socioeconomic standings. Thus, the project's results support what the theory of rational actors would likely suggest. At the same time, depending on the situation and their frame of reference within the social environment, parents and children also maintain quite stable aspirations and act in normative ways. That result supports the theoretical idea of a cognitive dual process model assuming different action logics and modes of decision-making, including those suggested by the model of frame selection.

Recommendations for Policy

For policymakers and school practitioners, the empirical findings of BiKS Project 5 suggest four recommendations for creating a supportive learning environment in schools and promoting greater equity in educational opportunities. First, the results concerning how social relations influence children's success in education stress the centrality of intra-family and family-school relations. Because parents sometimes feel overwhelmed with questions regarding their children's upbringing and education, an important policy goal should be to establish support networks, strengthen self-organized networks, and promote professional family support. Indeed, some types of parental training and support have been shown to reduce problematic behaviors and conflicts within the family (Villiger et al. 2010; Wild and Gerber 2009).

Second, it seems necessary to advance the competencies of teachers. Teachers can positively influence the self-concept of students through their relationships with children and their feedback. For teachers, continuous training could also be a way to strengthen their didactic and pedagogical skills. Another important goal should be to improve communication between families and schools. Ideally, parents should obtain the information that they need through a steady, direct flow of information from schools and teachers, which would provide more behavioral security for parents.

Third, the findings of BiKS Project 5 also point to the need for greater equality in educational opportunities in school. The limited possibilities for correcting decisions about the type of school to attend later in a student's academic career, especially regarding transitions to more demanding secondary schools, and the fact that the early division of students to secondary school tracks after primary school leads to scissor effects in the development of children's achievement at school and remain problematic. Therefore, particularly disadvantaged groups could benefit from a later transition to more ambitious tracks in order to compensate for lower competencies at the beginning of primary school. The expansion of all-day schools with individual support could also be a way to reduce social inequalities. All-day schools and afterschool programs are a relief for families, and they reduce or even eliminate the need for tutoring. Empirical evidence from BiKS Project 5 suggests that school-based assistance with homework and full-day services are associated with a lower likelihood of using tutoring (Guill 2012). In that respect, offering individualized support is important. The results of the project also show that anticipated costs lower parental aspirations, especially for children from lower social classes. Because educationally disadvantaged parents are more likely to decide against Gymnasium for their children at the end of Grade 4, even despite a teacher's recommendation, more attention needs to be paid to counseling those families. In that case, information about the necessary requirements as well as available support options and possibilities of later corrections of type of school could be a way to boost the educational opportunities of children from educationally disadvantaged families.

Last, in Germany, a society that strives for equal opportunity, the transition to secondary school should be uniformly regulated regarding parents' and teachers' decisions across all federal states. Those countrywide standards for secondary school entrance requirements could reduce unequal educational opportunities.

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Differential School Trajectories and Educational Decisions of Migrants in Germany—Descriptive Results and Theoretical Explanations

Hans-Peter Blossfeld and Markus Nester

Abstract

BiKS Project 7 investigates the mechanisms of disparities in educational success by migration background, especially among students from Turkey, before and after the transition from primary to secondary school in Germany. Using data from the BiKS-8-18 cohort, educational disparities between children with and without an immigrant background were empirically examined using the theoretical distinction between primary and secondary effects of social origin developed by Boudon. The results of the project show that the importance and mechanisms of primary and secondary effects on educational participation differ between students with and without immigrant background. On the one hand, the primary effect of social origin is much stronger for migrant children due to often insufficient German language skills, a lack of context-specific German cultural capital, and familial cultural capital that has lost at least some of its value due to migration. In contrast, the secondary effects of social origin are much weaker for migrant children: When children's academic performance is controlled for, migrant children have a higher transition rate to upper secondary school, regardless of their social class of origin. Thus, migrant parents'

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realization of more ambitious educational goals for their children (small secondary effect) is primarily hampered by their children's poorer academic performance (strong primary effect).

Keywords

Immigrant and native children · Primary effect and secondary effect of social origin · Structural educational opportunities in the country of origin · Parental German language skills · Parental experiences with the German school system · Different school regulations in Hesse and Bavaria

1 Objectives and Research Questions of BiKS Project 7

The proportion of students with a migrant background in the German school system has increased significantly over the last three decades. These children often show higher school dropout rates, attain lower school grades, have the highest proportion of graduates without vocational qualifications, attend upper secondary schools less frequently, and are less likely to graduate from university than children from native families (e.g., Bildungsberichterstattung 2012, p. 70). However, there are also significant differences in educational attainment between migrants from different origin countries (Segeritz et al. 2010).

In Germany, the Turkish population is not only the largest migrant group, but also the group with the most pronounced disadvantages in the German school system (Kristen and Granato 2004). The aim of the BiKS Project 7 was to investigate the mechanisms of disparities in educational success (grades, competences, and transition probabilities) by migration background, particularly of students from Turkey, before and after the transition from primary to secondary school in Germany. This transition, which occurs between the ages of 10 and 12, is perhaps the most crucial branching point in the German education system.

In the BiKS Project 7, educational disparities between different immigrant and native-born groups were empirically explored by using Boudon's (1974) theoretical concepts of primary and secondary effects of social origin. The primary effect is the influence of the family of origin on a child's school performance (Breen and Goldthorpe 1997). It results from the interaction of a child's genetic makeup with class-specific primary socialization processes, cultural experiences in the family environment, parents' (German) language skills, and parents' potential to support their children in school. As all children in school are confronted with middle-class academic standards and German is the language of school instruction, children from lower social classes, parents with lower educational attainment, and specific migrant backgrounds (e.g., parents from Turkey) on average tend to perform worse at school than children from upper-class families, better educated parents, and native families.

Beyond these socially linked levels of school achievement, there is also the so-called secondary effect of social origin (Boudon 1974). This effect relates to the decision-making behavior of families who, due to their specific class situation, evaluate the costs and benefits of higher educational attainment differently (Breen and Goldthorpe 1997). For example, parents from different social classes tend to choose different educational pathways for their children even when their school performance is similar at the end of primary school (see the results of the BiKS Project 5 in Blossfeld et al. this volume). Several mechanisms are thought to influence the secondary effect. First, parents from higher social classes (which are normally better educated) typically have more ambitious educational aspirations for their children (cf. Gambetta 1996 and Blossfeld et al. this volume). Second, educationally disadvantaged parents from lower social classes, who do not have their own experience with upper secondary school, not only expect comparatively higher costs for more ambitious educational goals for their children, but they also rate their children's probability of success in upper secondary school as lower. And third, there is the status maintenance motive of families (see the results of the BiKS Project 5 in Blossfeld et al. this volume), i.e., status losses loom greater than status gains for all families (Kahneman and Tversky 1979). Thus, parents with higher status have a stronger desire in maintaining their social status over generations and to send their children to upper secondary schools than parents for whom this school type represents an advancement. In other words: It is not the expected absolute educational level of a child that counts for parental decisions, but the expected educational level of the child relative to that of the family—that is supposed to reproduce the social status of the family intergenerationally.

The literature shows that the mechanisms of primary and secondary effects on educational participation seem to be different for migrant and native German students. On the one hand, the primary effect of social origin is supposed to be much stronger for migrant children due to often insufficient German language skills, lack of context-specific German cultural capital, and a familial cultural capital which at least partly has lost its value due to migration. On the other hand, low social class position seems to be less important for migrants' secondary effects. Thus, the secondary effects are found to be significantly smaller for migrant children (Kristen and Granato 2004). In other words, when children's school performance is controlled for, migrant children have an even higher transition rate to upper secondary school. A first reason for this observation seems to be that immigrant parents hold extraordinarily high educational aspirations for their children in all industrial countries (Heath and Birnbaum 2007). When migration is voluntary and economically motivated, it appears to be closely linked to the hope of a better life in the destination country. However, since the first generation of migrants often finds itself in rather unskilled and low-paid manual and service jobs in the destination countries, they project their high aspirations for advancement into their children ('immigrant optimism hypothesis'; see Kao and Tienda 1995). A second, (complementary) explanation is immigrants' lack of familiarity with the German school system. For example, parents from lower social classes with an immigrant background might therefore easily overestimate their children's chances of making a successful transition to upper secondary school due to insufficient information about the academic performance requirements of different school types in Germany. Thus, the BiKS project 7 expected children with a migration background to have not only stronger primary effects but also smaller secondary effects compared to children of German origin.

Another important extension of Boudon's distinction between primary and secondary effects was introduced by Esser (2011, p. 10). He refers to teacher recommendations in the transition from primary to secondary school as the tertiary effect of social origin. It is well known that children from families with higher socioeconomic status are more likely to receive a recommendation for upper secondary school ('Gymnasium') from their teachers, even if their grades are basically the same (Ditton 2007; Ditton et al. 2005). The literature offers four explanations for this effect that are discussed below. BiKS Project 7 therefore investigated also whether and to what extent teacher recommendations influence the educational opportunities of native and students from different immigrant backgrounds in the transition to secondary school.

In addition, the BiKS Project 7 examined how different institutional arrangements and structures of the school systems in the federal states of Bavaria and Hesse affect the educational opportunities of children with migration background. In Bavaria, the transition from primary to secondary school is tied to a relatively strict teacher recommendation that is difficult for parents to circumvent (see Blossfeld et al. this volume). In contrast, parents in Hesse are less bound by teacher recommendations and are therefore freer to choose the future type of school for their children. Thus, the question arises how these regulations of teachers' recommendations influence the educational opportunities of migrant children.

Finally, the BiKS Project 7 was able to examine how the educational aspirations of parents (with and without a migration background) have changed in

Bavaria and Hesse based on their concrete transition experiences to secondary schools and their children's school biographies in secondary schools.

In summary, BiKS Project 7 addressed the following eight specific research questions:

1. How is the change in academic achievement of immigrant students in primary school affected by family's cultural capital?
2. How important is the proportion of children with a migration background in a school class for the acquisition of vocabulary and mathematical competencies by children with and without a migration background?
3. Are there differences in primary and secondary effects of social origin between native and immigrant children? Do immigrant children indeed have stronger primary and weaker secondary effects, and why?
4. Do lower educational opportunities in the parents' country of origin lead to higher educational aspirations of immigrant parents for their children in Germany?
5. What is the role of migrant's lack of familiarity with the German school system and migrants' parental German language skills?
6. How do teacher recommendations at the end of primary school affect children with low social status and migration background (tertiary effect of social background)?
7. What happens to the educational opportunities of migrant children when parents in different federal states are more (e.g., Bavaria) or less (e.g., Hesse) bound by teacher recommendations at the end of primary school?
8. How do the educational aspirations of parents with a migration background change after the children have made a concrete transition to a specific secondary school and families have gained their own experiences with secondary schools (stabilization vs. revision of previous educational decisions)?

The BiKS research group used the concept of place of birth of the parents to define participants as having or not having a migration background, although various other measures (nationality, year of immigration, everyday language spoken at home, subjective integration into German society, cultural identity) were also available in the data. According to this definition 1,700 of the 2,215 participating children in the first BiKS panel wave were defined as native Germans and just under a quarter of the stratified sample were classified as children with a migration background. This includes 205 children for whom one parent was born abroad and 311 children for whom both parents immigrated to Germany. The largest migrant group in the sample came from Turkey, with more than one hundred cases followed by migrants from eastern Europe (78 cases), southern Europe (59 cases) and the former Soviet Union (57 cases). Several attempts were made to get access to and enhance participation of migrant parents and children, e.g. disproportional stratified sampling of institutions with high, medium and low migrant share,[1] bilingual initial invitation letters and information booklets (German and Turkish) as well as bilingual questionnaires (cf. Kurz et al. 2007). Nevertheless, the case numbers were too small to run differential quantitative analysis on each of the various migrant groups. Due to missing data and panel attrition, the number of cases in the analyses varies also across waves and statistical analyses. Panel stability was somewhat higher for natives than for migrants. Heckman's (1979) sample selection corrections were therefore used in the estimated models to deal with these selection biases.

2 Primary and Secondary Effects of Social Origin and Migration Background

The longitudinal data from the BiKS-8-18 cohort (see Homuth, Schmitt et al. this volume) includes information about the most important actors in the educational process using detailed instruments. Children from Hesse and Bavaria were tested and surveyed in their class context, interviews were conducted with their parents, and teachers were asked to evaluate the respective school classes and single children participating in the study. This unique data source made it possible to investigate in detail the impact of primary, secondary, and tertiary effects of social origins and immigrant backgrounds as well as the influences of teachers and institutional settings in Bavaria and Hesse before and after the transition to secondary school (see also Artelt el al. (2013) for more details on the instruments and data). The quantitative analyses were also complemented by an in-depth qualitative study based on interviews with parents from Turkey.

How is the change in academic achievement of immigrant students in primary school affected by family's cultural capital?
We begin with a short description of the empirical results of the BiKS Project 7 regarding the explanation of primary effects of social origin at primary school

[1] This disproportional sampling was done for the kindergarten children in urban areas in the BiKS-3 -8 sample which is tied via school districts to BiKS-8 -18.

age. According to social reproduction theory, parents' cultural capital is central to children's educational success in school (Bourdieu and Passeron 1977). However, familial cultural capital is often context-specific, so that children with migration background may lose at least some of its value if families migrate from the origin to the destination country (Chiswick and DebBurman 2004). A lack of school-relevant skills within the family can hardly be compensated by the school institutions or the children's own initiatives. Thus, on average, children of migrants should have lower academic success in school than children from native families. Another, more optimistic theory is the cultural mobility model, which assumes that children with a migrant background can promote their educational success by making targeted investments in relevant cultural activities of the destination country—and thereby compensate for the lack of cultural family capital on educational success (Aschaffenburg and Maas 1997; DiMaggio 1982). To empirically test these two competing hypotheses, BiKS Project 7 used the measures on reading literacy (for details see Artelt et al. 2013, as well as Homuth, Schmitt and Pfost this volume and Pfost et al. this volume) as well as several indicators of cultural capital in the family: (1) parents' highest level of schooling, (2) the number of books in the household, (3) the frequency of parents' (usually the mothers') reading of books, newspapers, and attendance at high cultural events, and (4) data on whether the child likes to read, visit libraries, and attends high cultural events. In addition, for the immigrant children, BiKS recorded how often German and other languages are spoken at home.

Instead of describing the cultural capital of families and children only at one point in time (i.e., based on a cross-sectional observation), the BiKS Project 7 examined the gains in reading literacy from the third to fourth grade using a so-called 'value added model' (Schneider and Pfost 2013). The results of these analyses were, however, not so clear-cut: On the one hand, they support the assumption of social reproduction theory that there is a strong influence of parental formal education and parents' high-cultural activities on the development of children's reading competency. On the other hand, these results are consistent with an extended version of the cultural mobility model, which predicts a strong influence of students' reading behavior. Most of the indicators used on the different forms of cultural capital showed comparably high correlations with the reading literacy development among students from immigrant and nonimmigrant families. However, surprisingly, the language spoken at home had no particular significance for the growth of reading literacy from the third to the fourth grade. Although the BiKS Project 7 found that the achievement gap increases by social background and that cultural capital and cultural activities in the family are responsible for this change, the gap between children with and without an immigrant background did not widen over time.

How important is the proportion of children with a migration background in a school class for the acquisition of vocabulary and mathematical competencies by children with and without a migration background?

The BiKS Project 7 also investigated whether the proportion of children with an immigrant background in the school class has an influence on children's achievement development (primary effects). Here, following Duncan and Raudenbush (2001, p. 366), the vocabulary and mathematical competencies of students in primary school were analyzed (for a detailed description of the method, models and results see Schneider 2013). The following two hypotheses regarding the effect of the proportion of children with an immigrant background in the classroom were examined:

(1) A higher proportion of children with an immigrant background in the classroom, especially if these students have difficulties with the German language, leads teachers to lower their instructional level and thus reduces the learning progress of all students in the classroom, regardless of their immigrant background.
(2) A higher proportion of children with a migration background in the school class is associated with lower incentives for these children to learn German, as they may also talk in the (non-German) family language during breaks as well as before and after school (if children from the same language group attend the class). Thus, particularly children with an immigrant background should have a lower learning progress in German language skills.

The multilevel models of the BiKS Project 7 (Schneider 2013) show that vocabulary development increased independently of the proportion of children with an immigrant background in the classroom. However, a higher proportion of children with an immigrant background in the school class decreased the growth in mathematical competencies. Interaction effects between a student's migration background and the share of children with a migration background in the school class were not statistically significant. Hence, the results of the BiKS Project 7 only partly support the hypothesis that teachers adjust the pace of instruction to the immigrant composition of the children in the classroom. While it seems that mathematical competencies indeed change primarily as a function of classroom experiences, this cannot be found for vocabulary acquisition. One possible explanation could be that the latter might occur more in the family context than through structures provided by the classroom or classmates.

Are there differences in primary and secondary effects of social origin between native and immigrant children?
The descriptive results of the BiKS Project 7 demonstrate that the results differ according to whether parental social class[2] or parental educational attainment[3] is chosen as the indicator of social origin for native and immigrant students. While immigrant students from the salariat and intermediate classes perform similarly in school to their respective native groups, it is mainly working-class immigrants who perform significantly worse than their native counterparts. Thus, when social class is included in the statistical analysis, the problem of low-performing migrants is heavily concentrated in the lower social classes and does not affect migrant children from higher social classes to the same extent. However, when we look at parental educational level as the social origin measure, we see that immigrant students perform worse than natives at all levels of parental education.

BiKS Project 7 also estimated logistic regression models separately for each social class, controlling for school performance. The results show that children with an immigrant background tend to go to the Gymnasium also with lower school grades than natives. Native working-class parents move to the Gymnasium only when their grades are very good, while native white-collar parents send their children to the Gymnasium even when their grades are significantly lower. Thus, while the transition rates to upper secondary school of native children differ considerably by social class (strong secondary effect of social origin), migrant children choose the Gymnasium with roughly the same average grades across all three social classes (working class, middle class and white collar). In other words, they show a weak secondary effect of social origin.

Using counterfactual analysis (see Erikson et al. 2005), the BiKS Project 7 also examined the relative importance of primary and secondary origin effects for families with and without an immigrant background (Relikowski et al. 2009, 2010, 2012). This advanced analytical approach is based on a decomposition of children's class specific academic performance distributions and their respective transition probability functions to upper secondary school (Gymnasium). Counterfactual analysis allows to estimate two quantities (see Erikson et al. 2005): (1) what proportion of a given social group (e.g. working class families) would make the transition to the Gymnasium, if one would assume the school achievement

[2] Class was measured via occupational information on the current or last job coded in the EGP class scheme (see Erikson et al. 1992 for detailed description of the typology).

[3] Educational attainment of the parents was measured asking them about the highest school and vocational degree they had ever achieved using the German certificates as a reference.

distribution of a different social group (e.g., the salariat); and (2) what proportion of a given social group (e.g. working class families) would make the transition to the Gymnasium, if one would retain the school achievement distribution of this social group (e.g. working class families) and were to assume the transition probabilities to the Gymnasium of a different social group (e.g., the salariat). Using these estimated transition proportions to the Gymnasium, the average of the resulting two log odds ratios between two social classes can be used to estimate the respective primary and secondary effects for different social classes (Jackson et al. 2007).

The empirical results of this counterfactual analyses clearly show that primary effects played a major role for the transition decision—for both migrant and native children. In addition, the school performance of migrant children within each of the different social origin groups is always worse than that of native-born students. Thus, the results not only underline the outstanding importance of primary effects of social origin for the transition from primary to secondary schools, but also provide evidence for the decisive role of primary effects for immigrant children. In comparison, secondary effects of social origin were found to be less significant for migrant children than for children from native families. For any given social class and for comparable academic performances of children, students with a migrant background are more likely to go to the Gymnasium than native children. As expected, this is due to the higher educational aspirations of migrants. The higher educational aspirations of migrants compared to natives were then studied in BiKS Project 7 in more detail with both qualitative and quantitative methods.

Do immigrant children indeed have stronger primary and weaker secondary effects, and why? Results from a qualitative study

As early as the 1980s, empirical studies in Germany showed that among migrants, Turkish parents had significantly higher educational aspirations on average than native parents. The BiKS Project 7 therefore investigated in detail why migrant parents from Turkey showed much higher realistic educational aspirations[4] than natives at the transition to secondary school, even though their children had also a weaker school performance on average (Relikowski 2012; Relikowski et al. 2012).

[4] Realistic aspirations incorporate the perceived likelihood of successfully attaining a desired outcome considering influences such as school achievement and other potentially restricting factors (Haller 1968).

Two hypotheses explaining these higher educational aspirations among Turkish migrants were investigated, namely the immigrant optimism hypothesis and the information deficit hypothesis. The immigrant optimism hypothesis claims that immigrants are distinguished from the majority population by a particular strong desire for upward mobility, which is due to the fact that (voluntary) migration is only carried out when it is associated with a well-founded expectation of improved living conditions and socioeconomic opportunities (Kao and Tienda 1995). However, while the first generation of immigrants in the German labor market is often channeled into low occupational positions, parental expectations of advancement are then shifted to the next generation (e.g. Boos-Nünning 1989).

According to the information deficit hypothesis, incomplete information about institutional hurdles and academic performance requirements in the German educational system on the one hand and a misjudgment of their child's school performance due to parents' low familiarity with the German school system on the other hand leads to an overestimation of the probabilities of educational success and to the development of unrealistically high parental educational aspirations for their children. In a first step, these two hypotheses were qualitatively assessed and further developed using a subsample of parents with Turkish origin from the BiKS sample (Relikowski et al. 2012). 21 semi-standardized guided interviews were conducted with parent couples of Turkish origin at the end of primary school. The guidelines were designed taking into account relevant findings on parental educational aspirations (e.g., Kristen and Dollmann 2009) and results of the previous surveys. The qualitative methodology was based on the work of Hopf and Schmidt (1993). To this end, the interviews were coded with reference to the hypotheses. In subsequent steps, these hypotheses were supplemented or revised on the basis of the interviews, and case comparisons were used to identify central patterns of reasoning underlying educational aspirations. In order to be able to capture the specifics of the Turkish migration background that go beyond social status, interviews with parents of German origin ($n = 40$) were also comparatively analyzed. Based on the qualitative analyses, the following four central background aspects of parental educational aspirations could be identified (see again Relikowski et al. 2012 and also Yılmaz et al. 2011) which largely support the two hypotheses:

(1) It could be shown that, in addition to social origin and ethnic characteristics, it was important whether the Turkish parents had their own personal experiences with the German education system. Parents who were not familiar with the German school system considered a broader range of secondary school types for their children than those parents who had themselves attended

German schools. Like native parents, they tended to orient themselves to schools that are familiar to them.

(2) Parents of Turkish origin who did not attend the German school system are more likely to assess upper secondary schools as achievable for their children than parents who attended schools in Germany. This perspective is closely related to their specific perception of their child's school performance: Those parents who are less familiar with the German education system, focus more on their child's potential performance than their actual school performance. That perspective contrasts with the native comparison group. Parents with Turkish origin, especially if they have a low educational background, are more likely to see the opportunities of the German school system for their child than its limitations.

(3) It has been shown that Turkish parents, regardless of their background characteristics, are less intrinsically than instrumentally motivated with regard to their children's education. Thus, they view education as a means to (professional) opportunities on the labor market. Parents of Turkish origin express a strong desire that their children should later have better jobs and higher pay than they do. In contrast, native parents in particular pay more attention to their child's well-being during their school years.

(4) In contrast to native parents, Turkish parents clearly view education from a collectivist perspective. Attending secondary schools is thus less a question of the fit between a child's school performance and the type of secondary school, but rather an expression of the desire to counteract the perceived disadvantage as a migrant of Turkish origin in Germany as a whole.

In summary, it seems that parents of Turkish origin who have not internalized the ways of thinking and attitudes toward the educational system typical of their class situation interpret secondary school forms in Germany in the specific context of their migration background and thus make more "ambitious" transition decisions than native parents of the same social class.

The key findings of this qualitative study were tested in a quantitative analysis using the entire BiKS-8-18 cohort data set (see Relikowski 2012 for details). These analyses largely supported the findings of qualitative results. It was found that parents with a migration background who belonged to the working class and have a low level of education hold comparatively high realistic aspirations. This can be interpreted in terms of the immigrant optimism hypothesis because it is precisely the parents who were unable to realize their own hopes for social advancement through migration who projected their expectations to the next generation. Some of the immigrant parents indicated that they were unable to achieve their educational goals in their country of origin, and some others said that they were unable to get an adequate job in Germany for their educational qualification. Thus, instead of the expected social advancement through migration, a rather sobering reality of placement in unskilled jobs followed for many of these migrant parents. This experience, however, did not diminish their aspirations for their children's upward mobility—quite the contrary is the case. Turkish parents showed that their aspirations for their children's success in school were closely linked to their expectations of advantages in the labor market. Thus, their special appreciation of upper secondary school was strongly instrumentally motivated.

Do lower educational opportunities in the parents' country of origin lead to higher educational aspirations of immigrant parents for their children in Germany?
The quantitative analysis was also able to further explore the importance of parents' own educational careers for their educational aspirations (Relikowski 2012). The educational aspirations for their children were particularly high when parents had experienced structural barriers[5] to their own educational acquisition. Particularly migrants from countries with a low level of tertiary education, such as Turkey, had much higher expectations for their children's educational careers in Germany than migrant parents from countries with better access to higher education. The fact that information deficits act as a reinforcing factor for this stronger upward motivation could be demonstrated on the basis of various correlations: School performance of children plays clearly a minor role in the formation of realistic educational aspirations. Thus, despite their children's weak performance, many migrants form very ambitious educational aspirations. As a result, migrant children go to the Gymnasium even when their school performance in primary school is significantly poorer.

What is the role of migrant's lack of familiarity with the German school system and migrants' parental German language skills?
In the literature it has been often assumed that a lack of personal experience with the German school system (measured via school attendance in Germany) contributes not only to an overestimation of school performance of their children, but also increases the aspirations of migrant families. This relationship can be largely

[5] Structural barriers were operationalized via the "gross enrolment ratio" in tertiary education (UNESCO 2004).

shown in the quantitative analysis. In addition, it could be shown that not only the lack of experience with the school system plays a role, but also the lower school involvement of migrant parents due to language barriers (subjectively measured via respective questions in the parent interviews). This could also explain why the overestimation of school performance is particularly evident among immigrants of Turkish origin, who on average have poorer language skills than other immigrant groups (see, for example, Babka von Gostomski 2010). It would therefore be particularly interesting to conduct objective language proficiency tests among immigrant parents to examine these hypotheses. Although such direct language measurements were not available in BiKS-8-18, the findings on self-assessment of parental support potential point to the expected direction: If migrant parents indicated that they were hardly able to support their child in school matters, their educational aspirations were particularly pronounced. Again, this is especially true for parents of Turkish origin, but it is also important for migrant parents without own experience with the German school system. For native parents, on the other hand, the effect of their own ability to provide support points in the opposite direction, which would also be expected in terms of secondary effects of social origin.

Another empirical regularity that proved to be particularly relevant for the group of migrants of Turkish origin is their stronger focus on the child's perceived enjoyment of school. It appears that parents of Turkish origin tend to use subjective performance indicators rather than objective school performance when forming their educational aspirations. This may also be related to the fact that, especially for parents of Turkish origin, the child's anticipated school aspirations make a substantial contribution to the explanation of the low secondary effects of ethnicity in the transition decision to secondary school. In future studies, it would therefore be interesting to investigate whether the role of ethnic networks is of particular importance for migrants of Turkish origin (cf. the argumentation in Becker 2010), since as the largest ethnic group in Germany, they can draw much more broadly on their own ethnic community (cf. Haug 2010). Such a pronounced form of ethnic closure could contribute to orientation toward the norms and values prevailing in the social network and thus have a channeling effect on educational aspirations.

How do teacher recommendations at the end of primary school affect children with low social status and migration background (tertiary effect of social background)?

With regard to teacher recommendations in the transition from primary to secondary school, Esser (2011) suggested to speak of a tertiary effect of social origin. It is generally expected that children from families with higher socioeconomic status and better educational attainment are more likely to receive a recommendation for the Gymnasium from their teachers, even if their grades are comparable to those of children from lower social classes. Several explanations for this are offered in the literature. First, teachers expect parents from higher social classes to place more value on education. Second, these parents are expected to be more supportive of their children in high school. Third, teachers attribute lower future academic achievement to children from lower-education and lower-status families ('statistical discrimination'). And fourth, high status parents put pressure on teachers to get high school recommendations for their children. Although these explanations are generated for social status, similar mechanisms could be assumed for migration status as another social background category as well. However, the third explanation is less convincing, since it is regularly the case in Germany that teachers take over a class as early as the third grade and keep it until the end of primary school. Thus, teachers should have enough time to collect concrete information about the academic performance of their students in the school class in order to be able to make a well-founded recommendation.

A study from the Netherlands in the 1980s showed in addition that children with an immigrant background were even more likely to receive a teacher recommendation to attend a more challenging type of school. The authors of this study suggested a fifth explanation (see Driessen et al. 2008): if the children's performance levels are the same, teachers assume that migrant children have not yet been able to show their full academic potential because of language problems.

In the empirical analysis with the BiKS-8-18 data on teachers' preliminary and actual career recommendations, it first appears that the findings are consistent with the first two hypotheses on the importance of social origin, but the third hypothesis does not hold. When children have very good grades, there is no difference between teacher recommendations for the 'Gymnasium'. However, when children have only "good" or "still good" grades, there are large differences in teacher recommendations between children from lower, middle, or higher social status groups. In general, no particular disadvantages were found for students with an immigrant background (for detailed findings, see Schneider 2011).

What happens to the educational opportunities of migrant children when parents in different federal states are more (e.g., Bavaria) or less (e.g., Hesse) bound by teacher recommendations at the end of primary school?

Teacher recommendations at the end of primary school are more (e.g., in Bavaria) or less (e.g., in Hesse) binding and can therefore be more or less constraining for parents who want to send their children to upper secondary school. Dollmann

(2011) shows that for native children, binding teacher recommendations significantly reduce educational inequalities, because the actual educational success of the children is given a higher priority and "overoptimistic" educational aspirations of privileged parents lose some influence. But does this also apply to children with a migration background, especially those from lower social classes and with a low level of education? Probably not, because these parents are "overoptimistic" and their children show lower academic performance on average (Yılmaz et al. 2011). Thus, mandatory teacher recommendations (e.g., in Bavaria) will especially constrain the chances of migrant children from lower social classes, while non-mandatory teacher recommendations (e.g., in Hesse) will provide more room for migrant parents with "overoptimistic" ambitions.

How do the educational aspirations of parents with a migration background change after the children have made the transition to a specific secondary school and families have gained their own experiences with secondary schools (stabilization vs. revision of previous educational decisions)?
Finally, the BiKS Project 7 investigated whether and to which extent educational aspirations of migrant parents change over time in secondary school (see Relikowski 2012 for detailed information on methods and models). The results indicate a general trend towards a decrease in the high aspirations of immigrant parents. The group of migrants of Turkish origin again stands out in particular: If they show particularly high aspirations at the end of the third grade and in the middle of the fourth grade, a comparatively stronger revision of these aspirations occurs with the approaching and completed transition to secondary school, especially when taking into account the child's social background and school performance. The aspirations that were classified as 'unrealistically' high in primary school, especially among parents with Turkish origin, have therefore become increasingly 'realistic' in secondary school. Despite this observed 'revision' of the initially very ambitious aspirations, however, there is no complete alignment of aspirations with those of native parents. The relevance of migrants' higher educational aspirations can also be observed after the transition from primary to lower secondary school (Zielonka et al. 2013): a higher (but still small) proportion of these migrant students moves indeed up to higher secondary schools compared to native students. However, no statistically significant difference to native children was found with respect to downward moves to secondary school types—again also after controlling for children's performance in secondary school.

3 Some Policy Recommendations for Children with Migration Background

At the end of this summary of the empirical findings of BiKS Project 7, it should be emphasized that the realization of all migrant parents' more ambitious educational goals for their children (low secondary effect) is primarily hampered by their children's poorer academic performance (strong primary effect). This clearly implies that policy interventions for migrant children, especially migrant children from low social classes, need to focus on the primary effect. Weak immigrant students need earlier, better, and more individualized support from educational institutions throughout their educational careers (e.g., from children's day care centers, kindergartens, all-day schools, to comprehensive schools). Migrants in particular need more individualized and targeted high-quality German instruction by professionals. The example of Sweden shows (see Erikson and Rudolphi 2010) that reducing achievement gaps between children with native and migrant backgrounds is not entirely beyond the reach of education policy.

In addition, shifting the secondary school career decision to higher ages and more opportunities to revise the school career decision later in secondary school (e.g., second-chance education) could also contribute to more educational equality for children with migrant backgrounds.

Given the high proportion of migrants among unskilled school leavers, it would also be very effective if migrant students with weaker academic performance could receive better information at school about the unique opportunities in the German dual training system and the associated job opportunities. This could reduce the often-frustrating experiences (such as low pay, unskilled work, or high unemployment risks) of immigrant youth when they enter the labor market without vocational qualifications.

However, the quantitative and qualitative strengthening of the preschool sector should not only be central for children with a migration background, but also for native children from disadvantaged families, in order to counteract their unequal starting conditions in the school system (primary effect). In addition, educational policy measures for native children should target their strong secondary effect. This means that policies should lower the cost of education for poor parents from lower social classes and disseminate better information about the education system and the prospects of success in higher secondary schools.

The longitudinal analyses of the BiKS Project 7 reflect the historical situation in Germany in the 2000s. In the meantime, the influx of refugees and migrants has increased enormously, especially in the year 2015 and peaking again in recent days due to the war in Ukraine. Although the migration groups and the reasons for migration differ, most of the mechanisms reported in this paper are useful for the understanding of new migrant children in the German educational system. Certainly, further research is needed in this field. The NEPS (National Educational Panel Study) and its rich longitudinal data pool (which is conceptually reproducing and continuing the BiKS -8-18 Study on a national level) as well as the ReGES Study which addresses Refugees in the German Educational System will help us to improve our knowledge on these issues and policy recommendations. For an introduction and overview on those new studies and updated findings—which go beyond the scope of this volume—see e.g. Diehl et al. (2016), Kalter and Kogan (2020), Miyamoto et al. (2020), as well as Will et al. (2022, 2021, 2018).

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