

RESEARCH LINE 3

PROFESSIONAL COMPETENCE





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PROFESSIONAL COMPETENCE

Teachers' qualifications fundamentally contribute to the quality of the school system and are thus of particular importance for policy makers and society. Teachers' knowledge and further personal characteristics have a strong influence on the quality of their teaching as well as on their students' achievements. In this vein, Research Line 3 aims to obtain a better understanding of the developmental processes of teachers' characteristics relevant for successful teaching based on validated models of teachers' professional competence. One important model (shown in Figure 1) guided the so-called COACTIV-Project which was carried out by Baumert, Kunter and others in the domain of mathematics. In this model professional competence of teachers is distinguished into four facets, motivation, self-regulating abilities, beliefs, and knowledge (separated into content knowledge, pedagogical content knowledge, and pedagogical knowledge). In line with the IPN's mission, our work focuses on (prospective) biology, chemistry, mathematics, and physics teachers. Of particular importance is how these facets of professional competence are formed during different phases of teacher education. We thus strive to generate both theoretical and practical knowledge for the improvement of teacher education. Different types of studies, i. e., longitudinal, cross-sectional, and intervention studies are conducted to answer our research questions.



Figure 1. Model of teachers' professional competence.

RESPONSIBLE FOR
RESEARCH LINE 3:

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Concerning the different facets of professional competence, it is assumed that they are on the one hand affected by particular cognitive and non-cognitive entry characteristics such as general cognitive abilities or personality traits. On the other hand, teacher education programs provide learning opportunities which should foster the development of student teachers' professional competence. Yet even though teacher education programs' curricula focus to a large extent on professional knowledge, the optimal sequencing in formal learning opportunities for the different but interdependent knowledge domains (content knowledge, pedagogical content knowledge, pedagogical knowledge) are still unexplored. For instance, an open question in this context is the extent to which pedagogical content knowledge develops independently or rather in conjunction with content knowledge and how integration of these knowledge domains is best fostered. Further and beyond knowledge, teacher education programs rarely offer formal learning opportunities for learning and teaching related beliefs, motivation or self-regulating abilities. At the moment, empirical evidence is largely lacking on how for example adaptive or conversely maladaptive motivational orientations or self-regulating abilities develop over the course of teacher education, as well as evidence about the extent to which they are shaped by student teachers' course work or practical experiences during their studies.

In addressing these major issues, Research Line 3 focuses on three areas:

- How do professional knowledge, and motivational and affective characteristics of (prospective) teachers develop over time, particularly over the course of university studies?
- To what extent are trajectories in professional competence influenced by individual and institutional characteristics?
- How do the different aspects of professional competence interact and how do they (conjointly) relate to students' and teachers' outcomes?

The development of professional knowledge, and motivational and affective characteristics of (prospective) teachers

Two longitudinal projects, i. e., KeiLa (The Development of Professional Competence in Preservice Mathematics and Science Teacher Education) and PaLea (Panel Study of Teacher Students) investigate developmental trajectories of teachers' professional competence over the course of university studies. KeiLa has a particular longitudinal focus on professional knowledge of student teachers in biology, chemistry, mathematics, and physics. Of particular interest here is whether students at the end of their university studies reach the goals defined in the national standards for teacher education as proclaimed by the Standing Conference of the Ministers of Education and Cultural Affairs of the Länder.

Harms, U. & Riese, J. (2018). *Professionelle Kompetenz und Professionswissen [Professional competence and professional knowledge]*. In D. Krüger, I. Parchmann, & H. Schecker (Hrsg.), *Theorien in der naturwissenschaftsdidaktischen Forschung* (pp. 283–298). Berlin: Springer Spektrum.

Neumann, K., Kind, V., & Harms, U. (2018). Probing the amalgam: The relationship between science teachers' content, pedagogical and pedagogical content knowledge. *International Journal of Science Education (TSED)*. Advance online publication.

Großschedl, J., Welter, V., Harms, U. (2018). A new instrument for measuring pre-service biology teachers' pedagogical content knowledge: The PCK-IBI. *Journal of Research in Science Teaching*. Advance online publication.

Dreher, A., Lindmeier, A., & Heinze, A. (2018). What kind of content knowledge do secondary mathematics teachers need? A conceptualization taking into account academic and school mathematics. *Journal für Mathematik-Didaktik* 39(2), 319–341.

Schmidt, J., Klusmann, U., Lüdtke, O., Möller, J. & Kunter, M. (2017). What makes good and bad days for beginning teachers? A diary study on daily uplifts and hassles. *Contemporary Educational Psychology*, 48, 85–97.

While most of the university classes focus on the acquisition of professional knowledge, it is unknown how student teachers' motivational and affective characteristics are influenced by university courses. Therefore, the longitudinal PaLea study investigates effects of university classes on teacher students' motivation, emotions and personality factors.

While Palea and KeiLa form the heart of Research Line 3, several other projects complement the Research Line in addressing similar and/or additional research questions. A complete list of projects in Research Line 3 is provided at the end of this chapter.

Fostering student teachers' professional competence development

Several projects focus on institutional factors, curricula and university courses and investigate the extent to which they foster various aspects of student teachers' professional competence. For instance, STePS (Student Teacher Professional Development Study) started collecting data of student teachers' professional development during a large university-based intervention program at Kiel University in 2016. Also in cooperation with Kiel University (CAU-LIB program), we started three intervention projects (physics, chemistry, and educational psychology) to develop, implement and evaluate new university courses in teacher education that link theoretical knowledge acquired at university with school practice. Student teachers often have difficulties seeing the connection between their university studies and their future work in schools, but also lack learning opportunities for the development of domain-independent competences (such as social-emotional competence). As a consequence, these three intervention projects developed courses tailored specifically to future teachers and aimed to either make relations between university contents and school related content explicit and investigate whether this favourably influences student teachers' motivation and learning, or aimed to provide a learning opportunity for the development of social-emotional competence in order to better prepare student teachers for the intense and potentially stressful social interactions in their future classrooms.

Motivational and affective characteristics of teachers and interaction with professional knowledge

Beyond knowledge, motivational and affective characteristics of teachers play a key role in providing high quality instruction and in fostering students' learning and growth. Especially affective experiences of teachers in the classroom usually exhibit a high within-person dynamic, where spontaneous events in the classroom require immediate reactions by the



teacher, which cumulatively should relate to teachers' motivational orientations and occupational well-being. We utilize intensive longitudinal methods such as diary studies to capture this moment-to-moment dynamic and investigate within-person psychological mechanisms. For instance, in one diary study we investigated stress exposure as the imbalance between momentarily experienced stressor and resources and the extent to which stress exposure impacts the daily well-being of teachers. We found interindividual differences in that less experienced teachers responded differently to stress exposure compared to more experienced teachers, which bears important implications when it comes to optimally designing interventions for teachers.

Even though professional competence of teachers is the combination of knowledge and motivational and affective characteristics, these different facets are rarely investigated in conjunction to each other. Yet our findings show that knowledge and motivation of student teachers are intertwined and reciprocally related. In two studies based on KiL data in the domain of biology and physics we utilized the internal/external frame of reference model. Our findings support theoretical assumptions about the relation between student teachers' knowledge in two domains (i. e., pedagogical content knowledge and content knowledge) and respective self-concepts, evidencing that motivation and knowledge of student teachers are interdependent. This bears important implications for the optimal development of learning opportunities for different facets of professional competence (i. e., knowledge and motivation) and across different domains (i. e., subject matter, subject matter education, educational psychology).

Aldrup, K., Klusmann, U. & Lüdtke, O. (2017). Does basic need satisfaction mediate the link between stress exposure and well-being? A diary study among beginning teachers. *Learning and Instruction, 50*, 21–30.

Paulick, I., Großschedl, J., Harms, U., & Möller, J. (2017). How teachers perceive their expertise: The role of dimensional and social comparisons. *Contemporary Educational Psychology, 51*, 114–122.

1 The development of professional knowledge in mathematics and science university teacher education. Results from a longitudinal study (KeiLa)

Introduction



For successful teaching, teachers need professional knowledge, motivation, professional beliefs and self-regulatory skills – jointly known as teachers' professional competence (see Figure 1). University teacher education plays a central role in developing core aspects of teachers' professional competence, in particular professional knowledge. Yet, there is a lack of longitudinal studies on the development of student teachers' knowledge during that phase.

Objectives

The longitudinal study KeiLa was designed to investigate the development of professional competence of student teachers in science and mathematics. Due to its interdisciplinary focus on teacher education KeiLa is a collaborative project of all six IPN departments and Kiel University. Major research questions address effects of individual and institutional factors on the acquisition of content knowledge (CK), pedagogical knowledge (PK), and pedagogical content knowledge (PCK). Of further importance are reciprocal effects between the three types of knowledge and reciprocal effects among the different domains, e.g., is physics PCK influenced by math PCK and vice versa.

Method

Seven waves of data collection were completed at 25 German universities from 2014–2017. Professional knowledge was assessed four times by means of paper-pencil tests in the winter semester over a period of four years. Three additional time points (summer semesters 2015, 2016, 2017) served to collect questionnaire data by means of online surveys. The subsamples of student teachers majoring in biology, chemistry, mathematics, and physics comprised 299, 187, 316, and 123 participants, respectively. We measured science and mathematics student teachers' professional knowledge as well as other aspects of their professional competence to investigate individual and institutional determinants of the formation of different aspects of student teachers' professional competence.

As an example outcome, we present the following findings predicting initial level and change in CK and PCK for physics student teachers. To measure physics students CK and PCK we utilized instruments developed in the precursor project KiL (Measuring the Professional Knowledge of Preservice Mathematics and Science Teachers, 2011–2014). The test for CK covers the core topics as stated by national standards for teacher education. The items for PCK covered the topics knowledge of student understanding, curriculum, assessment and instructional strategies. Maximum likelihood estimates from IRT analyses served as achievement indicators for CK and PCK. Predictors at the institutional level are number of semesters, number of subject courses and number of subject education courses. On an individual level we analyzed effects of GPA at the end of upper secondary school. GPA was selected because a large body of research has shown that this measure of global academic achievement is a strong predictor of university success.

Results

We used data from physics student teachers who had completed two consecutive paper-pencil assessments as well as one online survey. This in-

cluded 51 participants with a mean age of 21.9 years ($SD = 3.3$ years), 49% of which were female. Student teachers who participated at two consecutive measurement points did not differ significantly from those who participated only at the first measurement point in terms of their GPA, gender, their CK and PCK at the first measurement point.

Overall the 51 physics student teachers significantly improved both their CK as well as their PCK over the course of a year. While there was a large effect for CK ($d = 0.77$), PCK increased to a lesser extent ($d = 0.39$). Participants also reported the number of physics courses and physics education courses completed during the last two semesters. On average, physics student teachers had attended 6.5 physics courses ($SD = 3.5$), but only 1.3 physics education courses ($SD = 2.4$). Latent change models were applied to investigate effects of predictors on initial achievement (intercept) on change (slope) of CK and PCK. The results (standardized regression coefficients) are displayed in Table 1. Note that high GPA scores in Germany indicate low overall achievement. Number of semesters and GPA had significant effects on initial CK and PCK, i.e., the higher the number of semesters the higher initial CK, and higher GPA (lower overall achievement) corresponded to lower initial CK and PCK. Both predictors, however, had no effects on change

Table 1. Prediction of student teachers' CK and PCK in physics; findings from latent change analyses (standardized regression coefficients with $p < .05$)

	Dependent variables			
	Initial CK	Change in CK	Initial PCK	Change in PCK
<i>Predictors</i>				
Number of semesters	.39			
Number of CK courses		.56		
Number of PCK courses		.31		
GPA	-.41		-.39	

Bruckermann, T., Ochsen, F., & Mahler, D. (2018). Learning opportunities in biology teacher education contribute to understanding of nature of science. *Education Sciences*, 8(3), 1–18.

Sorge, S., Kröger, J., Petersen, S. & Neumann, K. (2017). Structure and development of pre-service physics teachers' professional knowledge. *International Journal of Science Education*. Advance online publication.

in CK and PCK, but number of courses in physics and physics education were predictive for change in CK. Contrary to our expectations, the number of physics courses or physics education courses did not significantly impact the development of student teachers' PCK.

Discussion

The results indicate that both individual and institutional determinants are important for student teachers' development during university training. However, there are significant differences in the number of physics courses and physics education courses. Physics student teachers attend approximately five times as many physics courses per week than physics education courses. This might be one reason for the strong effect of physics courses on the development of CK, and the missing effect of the number of physics education courses on PCK. Physics education courses also cover more diverse topics compared to the canonical topics in physics courses. Additionally, student teachers with a better GPA also show higher initial CK and PCK even when the number of semesters is controlled for. To gain a deeper understanding about the development of student teachers' professional knowledge, additional analyses should also consider the interplay between individual characteristics and characteristics of learning opportunities that go beyond the mere number of courses. The KeiLa project allows following the development of student teachers and provides valuable insight into the effectiveness of university teacher education.

IPN RESEARCH GROUP // Andrea Bernholt, Till Bruckermann, Ute Harms, Aiso Heinze, Stefanie Herzog, Jessica Hoth, Uta Klusmann, Olaf Köller, Anke Lindmeier, Daniela Mahler, Carolin Meyer, Knut Neumann, Ilka Parchmann, Stefan Petersen, Dustin Schiering, Stefan Sorge, Mirjam Steffensky, Steffen Tröbst, Anja Zerrenner

FUNDED BY // Leibniz Association

DURATION // 2014–2018

COOPERATION // Kiel University

HOME PAGE // www.ipn.uni-kiel.de/de/forschung/projekte/keila

2 Student teachers' professional development. Design, research questions and exemplary results from the panel study of teacher students (PaLea)

Introduction

PaLea examines student teachers' professional development throughout their university studies and in-service training with regard to their individual determinants like for example socio economic status (SES), personality, general cognitive abilities and varying institutional conditions like teacher professionalization programs, structure and quality of learning opportunities (see Figure 2 for details to the theoretical model). The focus of the panel study lies on the development of motivational orientations and beliefs, values, and goals as well as generic competences like self-regulation and cooperation. The longitudinal design of the study primarily allows tracking the development of professional competences across the university-based period of teacher education and also throughout the induction phase into the profession.

Overall, a sample of 7 065 student teachers from thirteen German universities was repeatedly asked to fill out a questionnaire. Detailed information was also collected about the specific curricula of all of the participating universities including among other things study programs for example, time and period of internships, and credit points in different do-

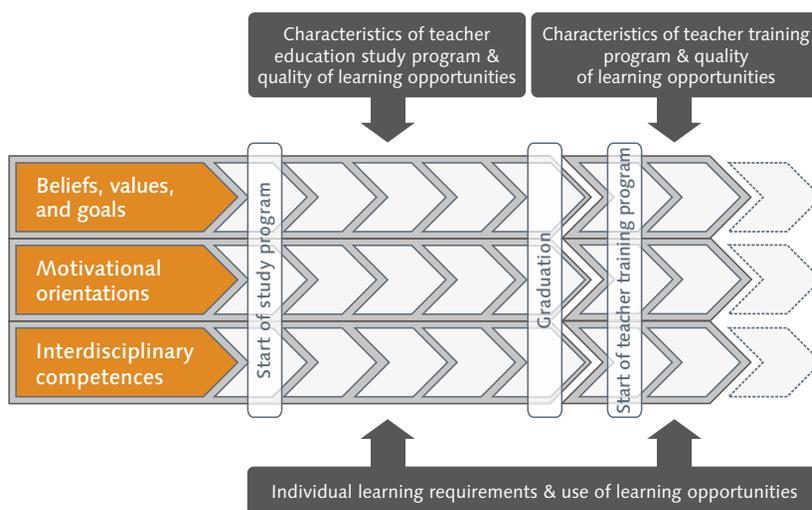
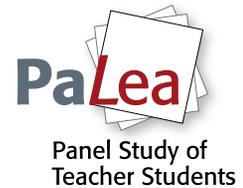


Figure 2. Conceptualization of student teachers' professional development in PaLea.

mains. The panel started in fall 2009 (Cohort 1) and fall 2010 (Cohort 2) using a paper and pencil questionnaire, followed by online-based questionnaires three times a year. Documents concerning the teacher education programs were also collected at the beginning and followed up every year until 2012 (see Figure 3 for the sample design). The sample included 5 492 teacher students in the 1st university semester and 1 573 teacher students of the advanced university study (including 1st semester master students and students of the 7th semester of State Examination) at the first measurement point.

Institutional level: Structural features of universities



Individual level: Characteristics of prospective teachers

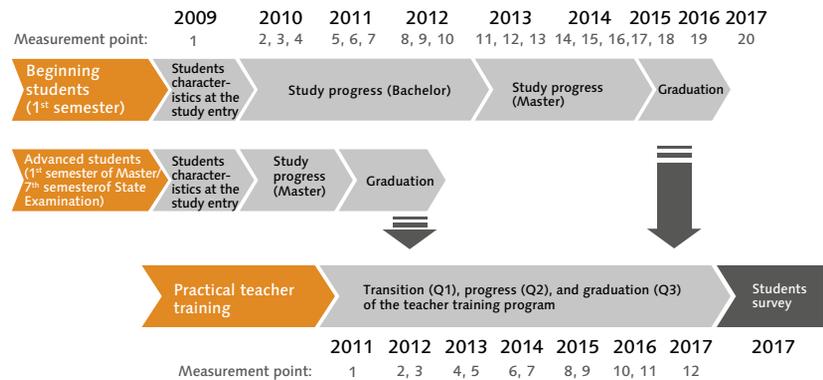


Figure 3. Sample and design of PaLea.

Development of professional competences in elementary school student teachers

With regard to one of the overarching aims of describing if and how structural differences in varying study programs influence the professional development of teacher students, a current study focuses on elementary school teacher students and their professional competences regarding teacher-related self-concept as well as their individual beliefs about teaching.

Research questions and design

Specifically, the research questions comprise aspects about the institutional as well as the individual level of PaLea (see Figure 3):

- How can the different study programs for elementary school teachers be classified according to structural aspects like credit points in several domains, time point and period of internships etc.?
- How do professional competences of elementary school students in terms of their teacher-related self-concept and individual beliefs about teaching change during the first three years of their university studies?
- To what extent can these changes in professional competences be explained by structural aspects of the different study programs?

To answer the research questions, our study used portfolios of course-relevant documents as well as a sample of 1 116 students from the corresponding universities. These public universities represent the different teacher education programs in Germany (non-modularized and modularized state examination, polyvalent and professionally specific bachelor's/master's degree programs, see Table 2). The university portfolios describe the program for each university including number of semesters until graduation, number and time period of internships, number and content of the different lectures/modules and so on. The indicators used for the institutional level (program structures) in this study were *type and duration* of teacher education programs, and the *number of credit points (ECTS)* for the different study areas (two subjects, for both subjects didactics, educational sciences, psychology, and internships).

Kauper, T., Bernholt, A., & Bauer, J. (2018). Zur Entwicklung professioneller Haltungen bei Studierenden des Grundschullehramts im Kontext heterogener Studienstrukturen [Development of professional competences in primary school teacher students considering heterogeneous opportunities to learn]. *Zeitschrift für Grundschulforschung*, 11(2), 231–251.

Table 2. Distribution of the university and student sample between the different elementary teacher education programs

	State examination programs		Bachelor's / Master's degree programs	
	non-modularized	modularized	polyvalent	professionally specific
$N_{\text{universities}}$	2	1	4	2
$N_{\text{teacher students}}$	303	76	404	333

On the individual level, data of 1 116 elementary school student teachers were used at two measurement points. These measurement points represent the beginning (T1) and the end of the third year (T2) of university studies. The teacher-related self-concept of subject and education and

the transmissive and constructivist beliefs about teaching were used as facets of professional competence. The teacher-related self-concept comprised items like 'I am not being troubled by the content of my university subjects' for the subject-related self-concept (4 Items, T1/T2: $\alpha = .76/.83$) and 'I have fun in motivating school children' for the education-related self-concept (4 items, T1/T2: $\alpha = .73/.78$). Teaching beliefs were measured with the degree of agreement to associations concerning lesson behavior as for transmissive beliefs 'reporting' or 'writing on the board' (6 items, T1/T2: $\alpha = .78/.86$) or items like 'rouse interest' and 'encouraging' assessing the constructivist teaching beliefs (7 items, T1/T2: $\alpha = .77/.76$).

Results

Summarizing the portfolios on the institutional level, the results indicated a high level of heterogeneity between universities which was due to the different combinations of the study programs. However, a systematic variation could also be shown with regard to educational sciences and internships: Profession-specific teacher education programs offered educational sciences earlier on in university studies and more internships were completed than teacher education programs referring to a polyvalent bachelor's degree program.

On the individual level, there were only slight changes in the self-concept facets over time ($SC_{\text{Subject}}: M_{\text{diff}} = -0.04, SE = .03, z = -1.36, n.s.$; $SC_{\text{Education}}: M_{\text{diff}} = 0.01, SE = .02, z = 0.57, n.s.$). Moreover, significant interindividual differences could be observed ($SC_{\text{Subject}}: \sigma^2 = .17, p < .01$; $SC_{\text{Education}}: \sigma^2 = .09, p < .01$).

In contrast, a substantial decrease in transmissive teaching beliefs could be observed over the first three years of study ($M_{\text{diff}} = -0.70, SE = .05, z = -12.97, p < .01$). The constructivist teaching beliefs increased slightly ($M_{\text{diff}} = 0.08, SE = .03,$

$z = 3.44, p < .01$). Both results indicate that elementary school student teachers to a lesser extent believe in transmissive teaching styles defined by teacher-centered lessoning and were – at the same time – more likely to share the idea of a constructivist learning setting in school with an active and participating role of students and an effective strategy for learning seen in cognitive activating teacher behavior. The analyses further confirmed significant interindividual differences (transmissive teaching belief: $\sigma = .45, p < .01$; constructivist teaching beliefs: $\sigma = .14, p < .01$).

In a second step, we examined whether these individual changes are related to variables on the institutional level. For this purpose, intra-class correlations for the competences between the nine universities and the different teacher education programs were analyzed (see Table 3). The findings showed that the teacher-related self-concept and individual teaching beliefs at both measurement points were independent of the university and the teacher education programs. Although the correlations were higher at the second time point, even a maximum of 5.9% of the variance of transmissive teaching beliefs after three years of study could be attributed to differences between the universities. With regard to the teacher education programs, the correlations were similar; the highest intra-class-correlation could be observed with 6.7% of the variance in the constructive teaching beliefs at the second measurement point. Overall, it can be assumed that both – the university and the teacher education programs – are only slightly related to the individual change of teaching beliefs and the professional self-concept.

Finally, it was examined whether the change in teaching beliefs can be explained by the extent of the study areas. The results showed that individual development cannot be explained by the study programs at the institutional level in terms of credit points regarding the different domains (subject, subject matter, educational

Table 3. Intra-class-correlations of the facets of professional competence between universities and teacher education programs

	Time	Universities	Teacher education programs
Subject-related self-concept	T1	.043	.008
	T2	.049	.011
Education-related self-concept	T1	.002	.002
	T2	.017	.003
Transmissive teaching beliefs	T1	.023	.027
	T2	.059	.015
Constructive teaching beliefs	T1	.006	.009
	T2	.051	.067

sciences) or credit points in internships. Only the number of internships had a (negative) influence on the change in constructive teaching beliefs ($\beta = -.27$; $p < .05$), whereby the explained variance was low (8%).

Discussion

Our results confirm the assumption of a high variability regarding the opportunities to learn in several teacher education programs. The findings on the individual change of prospective elementary school teachers showed a high stability of their professional self-concept over the first three years of their university studies. However, significant longitudinal changes could be observed with regard to their individual beliefs about teaching: Over the first three years of study constructive beliefs increased while

transmissive beliefs decreased. The results confirm the assumption that beliefs are changeable through teacher education. These observed changes should be interpreted positively for the intended competence development and therefore can be seen as a success of elementary school teacher education.

In summary, our analyses focused on the formal learning opportunities offered by universities and indicate that structural dimensions of the teacher education program only inadequately explain individual competence development with regard to self-concept and beliefs about teaching. About 93–99% of the variance of these competences after three years of university studies is grounded within the universities or the teacher education programs. This supports the assumption that student teachers' individual use of the opportunities plays a key role, as do the quality and content of the learning opportunities.



Perspectives for Research Line 3

We will continue our research on the development of professional knowledge of (prospective) science and mathematics teachers. The analyses of the longitudinal data from the KeiLa project will be of particular importance in Research Line 3. Longitudinal findings will provide insight into the level, the quality, and the development of prospective teachers' professional knowledge over the course of their university studies. Second, we will analyze the development of motivational and affective characteristics captured and traced by the PaLea project throughout university studies and the induction phase. The findings will provide answers to important questions regarding the development of professional motivation and self-regulatory characteristics of future teachers. In addition, we will continue the work on situation-specific skills such as professional vision in the in the context of elementary science education. The main aim of the upcoming work is to investigate the relation between PCK and professional vision with instructional quality in science classrooms.

Furthermore, we will continue projects to elucidate factors that influence the acquisition of professional knowledge, motivational and affective characteristics of (prospective) teachers. Here, our research will focus on concrete learning opportunities, the additional benefit of integrating digital tools in teacher education, and particular conditions for the development of cognitive as well as motivational-affective characteristics by teachers.

Finally, we will intensify international collaborations to get more insight into the diversity of the professionalization of science and mathematics teachers in Europe and to investigate cultural differences in teachers' professional behaviors and actions.

Projects in Research Line 3:

Project // Homepage	Teacher expectations, gender stereotypes and professional knowledge (TEG-Know) // www.ipn.uni-kiel.de/de/forschung/projekte/teg-know
Funded by	German Research Foundation (DFG)
Term	2016–2019
Departments involved	Mathematics Education
Staff (IPN)	Simone Dunekacke, Aiso Heinze
Cooperation partners	Universität Hamburg
Project // Homepage	Teacher noticing in Taiwan and Germany – what is the role of cultural norms regarding aspects of instructional quality? // www.ipn.uni-kiel.de/de/das-ipn/abteilungen/didaktik-der-mathematik/forschung-und-projekte/taiger
Funded by	German Research Foundation (DFG)
Term	2018–2021
Departments involved	Mathematics Education
Staff (IPN)	Anke Lindmeier
Cooperation partners	National Taiwan Normal University Taipei (Taiwan) // University of Education Freiburg
Project // Homepage	The development of professional competence in pre-service mathematics and science teacher education (KeiLa) // www.ipn.uni-kiel.de/de/forschung/projekte/keila
Funded by	Leibniz Association
Term	2014–2017
Departments involved	Biology Education, Chemistry Education, Educational Research and Educational Psychology, Mathematics Education, Physics Education
Staff (IPN)	Till Bruckermann, Ute Harms, Aiso Heinze, Stefanie Herzog, Jessica Hoth, Colin Jeschke, Melanie Keller, Anke Lindmeier, Daniela Mahler, Knut Neumann, Ilka Parchmann, Stefan Petersen, Dustin Schiering, Stefan Sorge, Mirjam Steffensky
Cooperation partners	Kiel University
Project // Homepage	Assessing subject-specific competences in teacher education in mathematics and economics (EIMaWi) // www.elmawi.de
Funded by	Federal Ministry of Education and Research (BMBF), priority program "Modeling and Measuring Competences in Higher Education"
Term	2016–2019
Departments involved	Mathematics Education
Staff (IPN)	Aiso Heinze, Colin Jeschke, Anke Lindmeier
Cooperation partners	Mainz University
Project // Homepage	Development of procedural knowledge in the simulated classroom (ProSim) // www.ipn.uni-kiel.de/en/research/projectlist/prosimbio
Funded by	Federal Ministry of Education and Research (BMBF)
Term	2017–2020
Departments involved	Biology Education
Staff (IPN)	Julian Fischer, Ute Harms
Cooperation partners	Kiel University
Project // Homepage	Student teacher professional development study (STePS) // www.ipn.uni-kiel.de/de/forschung/projekte/steps
Funded by	Federal Ministry of Education and Research (BMBF)
Term	2016–ongoing
Departments involved	Educational Research and Educational Psychology
Staff (IPN)	Uta Klusmann, Christoph Lindner
Cooperation partners	Educational Science, Kiel University
Project // Homepage	The PaLea study (PaLea) // www.ipn.uni-kiel.de/de/forschung/projektliste/palea
Funded by	Federal Ministry of Education and Research (BMBF)
Term	2008–2018
Departments involved	Educational Research and Educational Psychology
Staff (IPN)	Andrea Bernholt, Tabea Kauper, Olaf Köller
Cooperation partners	Kiel University // University of Erfurt // TUM School of Education

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Project // Homepage	Videobased analysis of instructional support in primary science education (ViU) // www.ipn.uni-kiel.de/de/forschung/projekte/viu
Funded by	Federal Ministry of Education and Research (BMBF)
Term	2009–ongoing
Departments involved	Chemistry Education
Staff (IPN)	Anja Fiebranz, Mirjam Steffensky
Cooperation partners	University of Erfurt // University of Münster
Project // Homepage	Labour market prospects through science and mathematics (PANaMa) // www.panama-project.eu
Funded by	European Union, program INTERREG 5a
Term	2015–2018
Departments involved	Chemistry Education, Mathematics Education
Staff (IPN)	Aiso Heinze, Stefanie Herzog, Lorenz Kampschulte, Anke Lindmeier, Frank Lüthjohann, Birte Niebuhr
Cooperation partners	University of Southern Denmark Odense
Project // Homepage	Promoting instructional coherence in science through teacher education (PICoSTE) // www.ipn.uni-kiel.de/de/forschung/projekte/picoste
Funded by	ERASMUS+
Term	2017–2019
Departments involved	Physics Education
Staff (IPN)	Knut Neumann, Jeff Nordine
Cooperation partners	University of Bergen // University of Copenhagen // University of Duisburg-Essen // University of Halmstadt // University of Helsinki // University of Usak
Project // Homepage	Supporting mathematics and science teachers in addressing diversity and promoting fundamental values (MaSDiv) // masdiv-project.eu
Funded by	ERASMUS+
Term	2017–2020
Departments involved	Physics Education
Staff (IPN)	Katrin Engeln, Alice Langhans, Knut Neumann, Stefan Sorge
Cooperation partners	Hacettepe University // Ministry of Education and Culture Cyprus // Ministry of Education, Culture and Science Netherlands // Ministry of Education and Employment Malta // Ministry for Education, Youth and Sports Baden-Wuerttemberg // Spanish Ministry of Education, Culture & Sport // Turkish Ministry of National Education // University of Education Freiburg // University of Jaen // University of Malta // University of Nicosia // Utrecht University
Project // Homepage	Design and implementation of video instruction in biology lessons as a part of teacher education (VisiBLE) // www.ipn.uni-kiel.de/en/research/projectlist/visible
Funded by	Joachim Herz Stiftung
Term	2018–2019
Departments involved	Biology Education
Staff (IPN)	Till Bruckermann, Daniela Mahler
Cooperation partners	
Project // Homepage	Media in mathematics and science education (MiU) // www.ipn.uni-kiel.de/de/forschung/projekte/miu
Funded by	Joachim Herz Stiftung
Term	2016–2018
Departments involved	Mathematics Education
Staff (IPN)	Anke Lindmeier, Anje Ostermann
Cooperation partners	Deutsches Museum Munich // Humboldt-Universität zu Berlin // University of Duisburg-Essen
Project // Homepage	Student labs in teacher training programs (KiFoLa); project in the network Lehr-Lern-Labore // www.ipn.uni-kiel.de/en/research/projects/kifola
Funded by	Deutsche Telekom Stiftung
Term	2014–2018
Departments involved	Biology Education, Chemistry Education, Mathematics Education, Physics Education
Staff (IPN)	Irene Neumann, Knut Neumann, Ilka Parchmann, Julia Schwanewedel, Stefan Sorge
Cooperation partners	Network Universities: Carl von Ossietzky University of Oldenburg // Freie Universität Berlin // Humboldt-Universität zu Berlin // University of Koblenz-Landau // University of Münster

Project	The role of teacher professional knowledge for planning mathematics instruction
Funded by	DAAD – German Academic Exchange Service
Term	2016–2017
Departments involved	Mathematics Education
Staff (IPN)	Aiso Heinze, Jessica Hoth, Anke Lindmeier
Cooperation partners	National Taiwan Normal University Taipei (Taiwan)
Project // Homepage	App development in biology and computer science teacher education (AppLauS) // www.ipn.uni-kiel.de/en/research/projectlist/applaus
Funded by	Kiel University (PerLe)
Term	2017–2018
Departments involved	Biology Education
Staff (IPN)	Daniela Mahler
Cooperation partners	Department Computer Science (Kiel University)
Project // Homepage	Supporting the relation of academic content knowledge and school related content knowledge of pre-service chemistry teachers within the framework of the CAU program "Lehramt in Bewegung" (CAU LiB) // www.ipn.uni-kiel.de/de/forschung/projekte/cau-lib-chemie
Funded by	Kiel University
Term	2016–2019
Departments involved	Chemistry Education
Staff (IPN)	Jenny Stäcker, Mirjam Steffensky
Cooperation partners	Kiel University // University of Duisburg-Essen
Project // Homepage	Pre-service teachers' social and emotional competences: Development of a research-based training program (SOKO) // www.ipn.uni-kiel.de/en/research/projects/cau-lib-soko-I
Funded by	Kiel University
Term	2015–ongoing
Departments involved	Educational Research and Educational Psychology
Staff (IPN)	Bastian Carstensen, Uta Klusmann
Cooperation partners	Kiel University
Project // Homepage	Teaching profession: The interplay of subject and teaching methodology in teacher training (CAU LiB/Physics) // www.ipn.uni-kiel.de/en/the-ipn/departments/physics-education/projects/cau-lib
Funded by	Kiel University
Term	2015–2019
Departments involved	Physics Education
Staff (IPN)	Jasmin Andersen, Knut Neumann
Cooperation partners	Physics Department (Kiel University)
Project	Test of regulation in and understanding of social situations in teaching (TRUST)
Funded by	Kiel University
Term	2015–ongoing
Departments involved	Educational Research and Educational Psychology
Staff (IPN)	Karen Aldrup, Bastian Carstensen, Uta Klusmann
Cooperation partners	Kiel University
Project	Teachers' occupational well-being – a diary study (TODAY)
Funded by	
Term	2015–ongoing
Departments involved	Educational Research and Educational Psychology
Staff (IPN)	Karen Aldrup, Uta Klusmann
Cooperation partners	