Some High-Priority PhD Dissertation Areas

Applications for PhD dissertations in the following research fields are especially encouraged:

**Intersection 1: Learning Processes and Outcomes**
- Randomised field trials/large-scale intervention studies to increase student motivation
- Use of tablet computers in schools
- Scientific literacy/scientific reasoning
- Embodiment

**Intersection 2: Educational Neuroscience**
- Neuronal correlates of motivation and engagement in classrooms
- Brain-computer interfaces in education

**Intersection 3: Mental Disorders and Learning in School**
- Processing of relevant social cues in classroom settings
- Perceptual alterations and cognitive correlates of disruptive behavior
- Prevention studies in the classroom

**Intersection 4: Language and Learning**
- Language technology in educational assessment
- Analysis of readability and relevance of linguistic complexity in education contexts
- Tutoring systems in real-life education contexts
- Development and evaluation of language learning apps for refugees

**Intersection 5: Education, Life Course Development, and Social Disparities**
- Social Inequality in the life-course
- Progress and persistence in higher education
- Educational trajectories and educational decisions
- Further education

Some potential projects (not exhaustive) are listed below.
Video-based analyses of high quality teaching in elementary school science education

Previous research has identified key factors of high quality classrooms: cognitive activation, individual support, and classroom management. However, as of today it is still a largely unresolved issue what these “basic dimensions of teaching quality” look like in elementary science teaching and how they can be best assessed. Video-based observations seem to provide a unique insight into classrooms and promise the most accurate assessments of teaching practice. In this PhD project, we want to apply these methods to find out what works best for children in terms of their cognitive and motivational development. The project has strong connections to the center of LEAD research, Education Sciences, and to Intersection 1—Learning Processes and Outcomes.

Supervisors: Benjamin Fauth, Richard Göllner

Innovative approaches to examine the complex interplay between teaching and learning: Mobile eye tracking and video-based observations

Previous studies have successfully identified characteristics of effective teaching and various approaches to measuring teaching quality. Modern conceptualizations regard learning as a process of active knowledge construction. However, we still don’t know how the interplay between teaching and learning really works. What are the different ways in which students use and process input from the learning environment? What kind of teacher behavior really leads to increased attention? Which features of challenging task assignments are associated with student cognitive engagement? In this PhD project we want to use mobile eye trackers and video-based classroom observations to explore new ways of investigating the complex interplay between teaching and learning. The project will be realized in the newly established Tübingen Digital Teaching Lab, which is very well equipped with the latest hardware facilities. It is thus perfectly suited for the above named research questions.

Supervisors: Benjamin Fauth, Katharina Scheiter, Benjamin Nagengast, Ulrich Trautwein
Adaptive Dynamics of Cognitive and Behavioral Variability in Children with Attention Deficit Hyperactivity Disorder: Long-Term Effects, Neural Bases, and Susceptibility to Intervention

In this project, we will investigate dynamics of adaptation in children with ADHD in the school context and analyze (1.) relationships between variability of ADHD symptoms, cognitive functions, and school behavior, (2.) associations between behavioral and brain signal variability, and (3.) predictive values of these aspects for long-term development. This is achieved by a longitudinal design with measurement bursts distributed across school grades five to nine. Daily assessment will include diaries, cognitive tasks, accelerometric assessment of physical activity, and classroom video recordings. Additionally, the role of self-regulation interventions in the school context will be evaluated.

Supervisors: Caterina Gawrilow, Thomas Dresler, Ann-Christine Ehlis, Tobias Renner, Andreas J. Fallgatter

Modeling Competence and Knowledge Growth

The project aims to develop and estimate econometric models of knowledge and competence growth in pupils and university students with particular focus on the determinants of growth trajectories, the heterogeneity of initial positions as well as growth paths, the potential dynamics and feedback effects between different forms of competencies and other personal characteristics. As a data base we intend to use different subsamples of the National Educational Panel Study (NEPS).

Supervisors: Martin Biewen, Augustin Kelava

Labor Market Success of University Graduates

The project aims to study the labor market success of graduates from German universities. Apart from background characteristics such as school grades, family background etc. the focus will be on richer information on study contents and conditions than used in previous studies e.g. type of university, subject of degree, specific courses attended, specific competencies acquired etc. As a data base we intend to use surveys of graduates at German universities.

Supervisors: Martin Biewen, Augustin Kelava
**Development of numerical competencies in secondary school**

There is accumulating evidence suggesting that arithmetic skills acquired during the first years of schooling build on preparatory basic numerical competencies also termed 'number sense'. This is reflected by the fact that number sense (including representations of e.g., symbolic and non-symbolic number magnitude) is a unique predictor of mathematical achievement in primary school. However, to date research on the influences of basic numerical competencies on children's numerical development almost entirely focused on primary school. Therefore, the current project aims at investigating in how far basic numerical competencies predict children's mathematical achievement in secondary school.

Supervisor: Korbinian Möller, N.N.

**Social information processing in school context**

The ability to correctly recognize and interpret nonverbal signals is vital for normal social development and highly relevant in educational settings. An adequate processing of nonverbal cues such as facial expressions is the basis of interpersonal relationships and social adjustment. Accordingly, deficient social affect processing has been linked to a number of psychiatric conditions, such as depression, anxiety and aggression. Unfortunately, we have a very limited understanding how the processing of facial expressions emerge in real-life interactions and how they are impacted by context variables.

For instance, why do some students perceive their teachers as less benevolent from the first lesson on? Which student characteristics predispose for a biased processing of positive or negative verbal cues from their teacher? How does the situational context, e.g., positive or negative performance feedback, aggravate or alleviate these biases?

Within the planned PhD project, we will make a first step into answering these questions by combining experimental and educational lines of research. We are looking for motivated individuals with some experience in the visual stimulus processing or related areas and/or educational science methodology.

Supervisors: Aiste Jusyte, Ulrich Trautwein, Benjamin Nagengast, Richard Göllner
**Working memory**

Working memory and related executive functions are characterized by profound effects on many cognitive, intellectual and school-relevant domains on the one hand as well as by a considerable inter-individual variability. In a new project, we will focus on cognitive, motivational and emotional effects of a working memory training in school and achievement contexts. We will also examine the potential of different interventions to improve training outcomes (e.g. adaptive task presentation or combination with neuroscientific tools such as non-invasive neurostimulation or neurofeedback). In addition to training effects in the working memory domain itself, transfer effects will be considered, particularly with respect to academic tasks such as reading comprehension and mathematical problem solving.

Supervisors: Peter Gerjets, Caterina Gawrilow, Maike Tibus, Ann-Christine Ehliis, Johanna Schmid

**Making sense of the past - individual prerequisites and instructional support**

Political developments in democratic societies are based on the attitudes and beliefs of majorities. To be alert to potential risks for basic democratic principles, it is essential that individuals identify historical patterns that may result in dangerous political developments and apply this knowledge to their reasoning about the present and the future. This process is referred to as Historical Literacy and transcends mere knowledge about important dates and facts. Furthermore the underlying reasoning processes are related to the reception and arguing with multiple documents and thus explore an important aspect of Reading Literacy in the 21st century.

In this PhD project, we want to investigate in how far different factors influence students’ processing of multiple historical documents in order to make an informed comment about a past event. Next to measuring individual prerequisites such as Historical Literacy or epistemological beliefs, we want to work on instructional interventions that may compensate for the lack of individual prerequisites that facilitate processing multiple historical documents to arrive at an informed conclusion. A concrete research agenda in the context of education science and psychology will be developed in line with the individual interests of the PhD student in close coordination with the supervisors.

Supervisors: Martin Merkt, Christiane Bertram, Stephan Schwan, Ulrich Trautwein
Perceptual alterations and cognitive correlates of disruptive behavior

Understanding and acting according to social norms is an important part of the socialization process. Some individuals however, strike a stable path of socially deviant behavior, which often has its roots in childhood and adolescence. Due to high societal costs and the chronic nature of antisocial and aggressive behavior, elucidation of factors associated with its emergence and maintenance is a highly relevant issue. Research evidence suggests that cognitive and neural mechanisms involved in social information processing may underlie the key aspects associated with the emergence of aggression. Furthermore, despite previous research attempts to understand the etiology of socially deviant behavior, we know virtually nothing about the cognitive processes occurring during the act of deliberate rule-breaking. Thus, the aim of the present PhD project will be the investigation of factors that contribute to the emergence and maintenance of disruptive behavior and associated psychopathologies (i.e., conduct disorder, antisocial personality disorder and psychopathy) using experimental paradigms derived from basic cognitive science and psychophysics. Successful candidates should have a pronounced affinity for experimental work, experience with experimental software, good data analysis and ideally programming skills, as well as an interest in work with clinical populations.

Supervisor: Aiste Jusyte, N.N.

Social inequalities in early childhood in cross-national comparison

Substantial social inequalities have been found already in early childhood. Yet the size of these differences varies significantly across countries. This project aims to provide a cross-national perspective on the importance of child care arrangements, parenting, and home learning environment for early childhood inequalities. It will draw on different psychological and sociological perspectives (e.g. primary and secondary effects of social background, concerted cultivation, identity and social learning theories) to develop and test theoretical predictions of how social inequalities are reproduced during early childhood and across the transition to primary school.

Most empirical cross-national studies to-date have focused on non-representative regional subsamples or solely on Anglo-Saxon countries. They considered mainly aspects of formal care or of the home learning environment. The analysis will explore more in detail than previous studies social disparities in take-up of formal, informal, and non-formal child care arrangements from birth to after primary school entry and examine to what extent these may account for progression in children’s cognitive skills and their social and emotional development. The project will compare Germany, the United Kingdom, and Australia. These countries provide an interesting comparison, as they are relatively similar in terms of widespread maternal part-time employment and half-day formal care use during early childhood. Yet they provide insightful contextual variations in terms of costs and quality of early childhood education programs for different socio-economic groups of the population.
The PhD thesis will draw on several large-scale longitudinal secondary data sets, including the National Educational Panel Study, the Millennium Cohort Study, and the Longitudinal Study of Australian Children, and apply panel data modelling, such as fixed-effects and growth curve models, and possibly sequence analysis. The ideal candidate should have some advanced quantitative methods skills and be interested in longitudinal data analysis.

Supervisor: Pia Schober, N.N.

Adolescent elite athletes: Athletic and academic performance, motivation, and identity

Adolescence is a particularly vulnerable stage of development for young elite athletes. Typical age-related bio-psycho-social changes induced by maturation go along with progressive increases in training load, greater competitive requirements and growing performance pressure. In this phase of their career, successful athletes are expected to prioritize sports at the expense of school, leisure time, profession, family, and friends. Athletes who choose a high-performance career find themselves in an "identity tunnel" and often develop an overconformity to the norms and values of the elite sport system. This “role engulfment” can impair the accomplishment of developmental tasks in non-sportive context.

The aim of this PhD project is to analyze how young athletes cope with strains associated with their engagement in elite sports and which role their social network plays in this process. In this regard, not only the athletes’ success in competitions but also their academic achievement, their achievement motivation, and their educational aspiration is of interest.

Candidates are expected to analyze data from an already existing large data set with a high number of young athletes that allows for a number of different statistical and methodological approaches.

Supervisors: Ansgar Thiel (and colleagues from the Institute of Sports Science) in collaboration with colleagues from the Hector Research Institute of Education Sciences and Psychology

How to acquire and transfer knowledge about effective teaching?

Knowledge about effective teaching and learning processes in the classroom constitutes a crucial part of teachers’ expertise. However, little is known about how (future) teachers acquire this kind of knowledge in the course of university-based teacher education, how they are able to transfer this knowledge to elements of praxis and how different instructional designs in teacher education could support the acquisition processes. This interdisciplinary project aims to investigate preservice teachers’ knowledge acquisitions by using data from the Observe and BilWiss projects as well as by conducting quasi-experimental studies.

Supervisor: Kathleen Stürmer, Thamar Voss, Benjamin Fauth