LEAD Retreat

Program

October 16-18, 2024

Schwäbisch Gmünd, Germany

Wednesday, October 16th, 2024

Day 1

Time	Topic	Place
07:15am	**Bus Departure in Tübingen**	*EU Fernbussteig Platform R*
09:00am – 9:30am	**Arrival at the Venue & Coffee and Snacks**	*Foyer*
09:30am – 09:50am	**Welcome and Introduction** *by the LEAD Co-Directors*	*Main Hall*
9:50am – 09:55am	**Organizational Information about the Retreat** *by LEAD Scientific Coordination*	*Main Hall*
9:55am – 10:45am	**New Members' Presentations**	*Main Hall*
11:00am – 12:00pm	**Conversations with Computer Agents in the Era of Generative AI** *Keynote by Art Graesser*	*Main Hall*
12:00pm – 01:00pm	**Lunch** with randomized seating order	*Restaurant*
01:00pm – 01:45pm	**Social Walk**	*Meeting Point: Foyer*
02:00pm – 03:00pm	**ILSAs & Meta-Analyses - How International Large-Scale Assessments Can Inform Meta-Analyses in Education** *Keynote by Ronny Scherer*	*Main Hall*
03:00pm – 04:00pm	**Poster Fair with Coffee**	*Foyer*
04:00pm – 05:00pm	**Input by the Vodafone Stiftung** *by Matthias Graf von Kielmansegg*	*Main Hall*
05:00pm – 06:00pm	**Poster Fair**	*Foyer*
06:00pm – 07:00pm	**Dinner**	*Restaurant*
07:00pm – 08:00pm	**PhD Assembly & Postdoc Assembly**	*Main Hall & Forum 2*
08:15pm – O.E.	**Social Event** *PhD Representatives & New PhD Candidates*	*Main Hall*

Thursday, October 17th, 2024

Day 2

Time	Topic	Place
07:00am	**Early Morning Run** *Katharina Leibfarth and Wy Ming Lin*	*Meeting Point: Foyer*
07:00am – 8:45am	**Breakfast**	*Restaurant*
08:45am – 09:00am	**Welcome & Pitches for the SIGs**	*Main Hall*
09:00am – 10:00am	**Illusory traits: Wrong but sometimes useful** *Keynote by Drew Bailey*	*Main Hall*
10:00am – 10:20am	**Coffee**	*Foyer*
10:20am – 11.20am	**Poster Fair**	*Foyer*
11:20am – 12:20am	**Special Interest Groups**	*Cf. appendix*
12:20pm – 01:20pm	**Lunch**	*Restaurant*
01:20pm – 02:00pm	**Social Walk**	*Meeting Point: Foyer*
02:00-02:15pm	**Group Picture**	*Foyer*
02:15m – 03:15pm	**AI meets Education in Tübingen** *Keynote by Matthias Bethge, Wieland Brendel and LEAD-PIs*	*Main Hall*
03:15pm – 04:15pm	**AI and Education: How do they go together?** *Fishbowl discussion*	*Main Hall*
04:15pm – 04:45pm	**Coffee**	*Foyer*
04:45am – 05:45pm	**LEAD Association Research Talks**	*Cf. appendix*
06:00pm – 07:00pm	**Dinner** with randomized seating order	*Restaurant*
	Social Gathering *Workshop Scottish Dancing*	*Foyer 2*

Newly associated LEAD members give a maximum 8-minute presentation on their research.

Friday, October 18th, 2024

Day 3

Time	Topic	Place
07:00am	**Early Morning Yoga** *Salome Flegr*	*Foyer 2*
07:00am – 08:45am	**Breakfast & Check-Out**	*Restaurant*
08:50am – 09:00am	**Welcome**	*Main Hall*
09:00am – 10:00am	**Should we teach grammar? A linguist's view on language learning and teaching** *Keynote by Dora Alexopoulou*	*Main Hall*
10:00am – 11:00pm	**Poster Fair with Coffee**	*Foyer*
11:00am – 12:00pm	**PhD Talks**	*Cf. appendix*
12:15pm – 12:30pm	**Wrap-Up**	*Main Hall*
12:30pm – 01:30pm	**Lunch**	*Restaurant*
02:00pm	**Bus Departure to Tübingen**	*Parking Lot*

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Keynotes
Wednesday, October 16th, 2024

11:00am –12:00 noon

Conversations with Computer Agents in the Era of Generative AI by Art Graesser

Art Graesser is a professor in the Department of Psychology and the Institute of Intelligent Systems at the University of Memphis, as well as an Honorary Research Fellow at University of Oxford. His research interests question asking and answering, tutoring, text comprehension, inference generation, conversation, reading, problem solving, memory, emotions, artificial intelligence, computational linguistics, and human-computer interaction. He served as editor of the journal Discourse Processes and Journal of Educational Psychology, as well as presidents of four societies, including Society for Text and Discourse, the International Society for Artificial Intelligence in Education, and the Federation of Associations in the Behavioral and Brain Sciences. He and his colleagues have developed and tested software in learning, language, and discourse technologies, including those that hold a conversation in natural language and interact with multimedia (such as AutoTutor) and those that analyze text on multiple levels of language and discourse (Coh-Metrix and Question Understanding Aid -- QUAID). He has served on five panels with the National Academy of Sciences and four OECD expert panels on problem solving, namely PIAAC 2011 Problem Solving in Technology Rich Environments, PISA 2012 Complex Problem Solving, PISA 2015 Collaborative Problem Solving (chair), and PIAAC Complex Problem Solving 2021.

02:00pm – 03:00pm

ILSAs & Meta-Analyses - How International Large-Scale Assessments Can Inform Meta-Analyses in Education by Ronny Scherer

Ronny Scherer is a Professor of Educational Measurement at the Centre for Educational Measurement (CEMO), University of Oslo. His research intersects measurement, assessment, and evaluation, with a focus on digital divides, equity and equality in education, and the measurement of complex cognitive skills such as problem-solving and computational thinking. His methodological expertise includes advanced meta-analytic techniques and multilevel structural equation modeling, particularly in the context of large-scale educational surveys like PISA and TIMSS. Prof. Scherer is also a co-director of the Centre for Research on Equality in Education (CREATE) and has been involved in numerous international research projects, including studies on digital equality and the adaptability of students in the 21st century. He regularly teaches courses on measurement models, multilevel models, and meta-analysis, and supervises Master's and PhD candidates interested in these areas.

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04:00pm – 05:00pm
Input from the Vodafone Stiftung by Matthias Graf von Kielmansegg and Sarah Franke

As Managing Director **Matthias Graf von Kielmansegg** is responsible for the strategic development and operational management of the Vodafone Foundation. Matthias Graf von Kielmansegg headed the Policy Issues and Strategies Department at the Federal Ministry of Education and Research for eight years. From 2005 to 2014, he initially headed the staff for political planning, policy issues and special tasks at the Federal Chancellery, later as group leader for the areas of families, senior citizens, women, youth, education and research, among others. He is a trustee of the Hoffbauer Foundation, the Fraunhofer Institute for Systems and Innovation Research ISI and the Humboldt University Foundation. Matthias Graf von Kielmansegg studied law at the Universities of Freiburg and Göttingen.
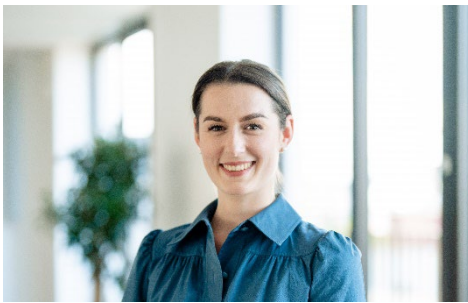
He is joined by **Sarah Franke**, the Head of European Think Tank - Digital Education & Democracy. She is responsible for all activities through which the European Vodafone Foundations, as a think tank and driving force, aim to rethink education for a digital society and improve opportunities for social participation. Sarah Franke previously worked as a project manager at Siemens Foundation in the field of STEM-education. She studied Intercultural Communication and ran the tutorial for international students at the same institute at Ludwig-Maximilians-Universität in Munich for several years. Sarah Franke is a doctoral researcher at Ludwig-Maximilians-University in Intercultural Communication.

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Thursday, October 17th, 2024

09:00am – 10:00am

Illusory traits: Wrong but sometimes useful by Drew Bailey

Drew Bailey`s research focuses on understanding the developmental processes underlying stability and change in children's academic achievement and on the medium- and long-term effects of educational interventions. His current work attempts to use psychological theories and methods to build models to improve the accuracy of predictions about the medium and long-term effects of educational interventions.

02:15pm – 03:15pm

AI and Education in Tübingen by Matthias Bethge, Wieland Brendel and LEAD-PIs

Matthias Bethge is a professor of computational neuroscience and machine learning at the University of Tübingen. He received his doctorate with the thesis *Codes and Goals of Neuronal Representations* from the University of Bremen in 2003. He then conducted postdoctoral research in California at the Redwood Neuroscience Institute in Menlo Park (since 2005 Redwood Center for Theoretical Neuroscience at the University of California, Berkeley). Since 2005, he has worked at the Max Planck Institute for Biological Cybernetics in Tübingen and was awarded the first Bernstein Prize for Computational Neuroscience in 2006. He conducts research in the field of computational neuroscience and uses mathematical methods and psychophysical experiments to investigate image processing and its neural basis in the human brain.

Wieland Brendel received his Ph.D. in computational neuroscience from the École normale supérieure in Paris (2014). He joined the University of Tübingen as a postdoctoral researcher in the group of Matthias Bethge, became a Principal Investigator and Team Lead in the Tübingen AI Center (2018) and an Emmy Noether Group Leader for Robust Machine Learning (2020). In May 2022, Wieland joined the Max-Planck Institute for Intelligent Systems as an independent Group Leader and is now a Hector-endowed Fellow at the ELLIS Institute Tübingen (since September 2023). He received the 2023 German Pattern Recognition Award for his substantial contributions on robust, generalisable and interpretable machine vision. Aside of his research, Wieland co-founded a nationwide school competition ([bw-ki.de](bw-ki.de)) and a machine learning startup focused on visual quality control.

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Friday, October 18th, 2024

09:00am – 10:00am

Should we teach grammar? A linguist's view on language learning and teaching *by Dora Alexopoulou*

Dr. Dora Alexopoulou is an Associate Professor at the University of Cambridge, specializing in First and Second Language Acquisition and Language Typology. She leads the EF Lab on Applied Language Learning and has a background in Greek Philology, Natural Language and Speech Processing, and Linguistics, with degrees from the University of Athens and the University of Edinburgh. Dr. Alexopoulou's research explores natural language syntax and its role in language learning, focusing on how linguistic diversity and mother tongue influence second language acquisition. She uses generative syntax and big data from online learning platforms to develop effective learning tools. In addition to her research, she teaches courses on Language Acquisition, Typology, and Syntax, and holds roles as an Alan Turing Fellow and editor of Languages, Society and Policy. She is also a co-founder of the Cambridge Bilingualism Network.

Organisational Notes

Venue

Schönblick
Christliches Gästezentrum Württemberg
Willy-Schenk-Straße 9
73527 Schwäbisch Gmünd

LEAD Info Point

During the event, our **LEAD Info Point** located in the foyer will be open to answer any question and make your stay as comfortable as possible.

Rooms

Please check-in at the reception. **Check-in** time for the bedrooms is usually from **03:00 pm**. **Check-out** time is before **09:00 am** at the hotel reception. You can leave your **luggage in the entrance area or foyer**.

Wifi

Tba

Seating Order

To provide an opportunity for you to get more familiar with all LEAD members, there will be a randomised seating order for **lunch on Wednesday** and **dinner on Thursday**. Please look for the place card with your name and enjoy an inspiring meal with your colleagues.

Beverages

Mineral water will be provided throughout the retreat. Coffee, tea and snacks will be provided during coffee breaks. We ask that you pay for all other drinks (especially during evening sessions) at the reception before you leave.

Travel Reimbursement

We kindly ask for your understanding that LEAD cannot pay a daily allowance (Tagegeld). The chartered bus and public transportation are the primary modes of transport. LEAD will reimburse your travel expenses (2nd class/economy). If your office is located in Tübingen, LEAD will not reimburse travel costs for other transportation (car, taxi etc.), except in justifiable cases.

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Program Notes

Poster Fairs

For the poster fair, the PhD candidates prepare posters and present their PhD projects in 2-5 minutes to small groups of other LEAD members and guests. Everyone is invited to ask questions or make comments.

Keynote Speech

Distinguished national and international guests are invited to give a talk about keynote topics. Everyone attending the retreat and especially our PhD candidates should make use of the opportunity to interact with the guests during coffee breaks and social activities.

Special Interest Groups

The so called "Special Interest Groups" (SIGs) give everyone the opportunity to discuss an individual topic with a smaller group of people to give or receive feedback (e.g. new research projects; new research idea; third party funding or any other proposals).

LEAD Association Research Talks

The so called **"LEAD Association Research Talks"** replace the "traditional LEAD interview" and take place during the LEAD Retreat. New members present their research or research plans briefly (**max. 8 minutes**, including Q&A); in parallel sessions to participants at the retreat.

Wednesday, October 16th, 2024

New Members' Presentations

Name	Status
Ann-Marie Buchmann	PhD Candidate
Behnaz Kiani	Postdoc
Eleni Kanli	PhD Candidate
Evelyn Schnaufer	PhD Candidate
Kirstin Schmidt	Postdoc
Marcel Capparozza	PhD Candidate
Nina Udvardi-Lakos	Postdoc
Noel Wytopil	PhD Candidate
Rebecca Beiter	Staff
Richard Schulte	PhD Candidate
Sophia Richardon	PhD Candidate
Thorben Jansen	Postdoc
Zachary Adolph Niese	Postdoc

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Poster Fairs

Wednesday, October 16th, 2024
03:00pm – 04:00pm

Name	Title of Poster
Ida Malini Syvertsen	Exploring Factors of School Leaders Innovation-Related Self-Efficacy
Irena Vanessa Ivan	Assisting video learning with ChatGPT-generated interpolated tests
Myriel Kopatz	Class Composition, Student Achievement, and the Role of the Learning Environment: A Conceptual Replication and Extension
Luisa Wellert	"Do-It-Yourself" and Adaptive? An Implementation Study on the Effectiveness of Self-Developed Adaptive Systems in the School Context
Ting-Yu Liu	Listening Comprehension in Adaptive Language Learning within a VR Environment
Heike Russ	Students' Academic Self-Concept and Conscientiousness Moderate the Effectiveness of Distributing Non-Interactive Teaching in School
Katharina Totter	Investigating the Role of Perceived Authenticity and Involvement in Learning with Eyewitnesses
Xenia Stein	An Asynchronous Online Proof Course – Effects on Children's Proof Competency and Motivation
Ulrike Michael & Julia Schmidt-Peterson	Teaming up with Schools & Research – What Do YOU Need?

Wednesday, October 16th, 2024
05:00pm – 06:00pm

Name	Title of Poster
Judith Havemann & Katrin Kunz	Promoting Computational Thinking and Mathematical Structuring Skills in Talented Children
Nora Fröhlich	Implementation and Effectiveness of an extensive reading and writing Training
Elizabeth Bear	Fostering Intercultural Competence Through a Task-Based Conversational Agent: An RCT
Marei Beukman	Promoting Engagement through Interactive Learning with Peers and Generative AI
Claudia Neuendorf	Systematic Review: The Effects of Classroom Heterogeneity on Students' Socio-Emotional Experiences
Katharina Leibfarth	Modelling Electricity: Students' Understanding of Simple Electric Circuits Based on Different Models
Aki Schumacher	Study Proposal: Need for Cognition, Behavioral Traces of Learning, and Academic Functioning
Sarah Löber	Automating Language Assessment with Intelligent Technologies
Leona Colling	How Do Language Learners Progress in Their Acquisition of Questions? A Developmental Sequence Analysis of Digital Practice
Darina Izhboldina	Effects of Pedagogical Agents on Learning Outcomes
Ulrike Michael & Julia Schmidt-Peterson	Teaming up with LEAD "Schools & Research": What do you need?

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Thursday, October 17th, 2024
10:20pm – 11:20pm

Name	Title of Poster
María Paula Villabona	Attentional Focus in Musical Performance: Insights from Motor Metacognition
Robin Wagner	Effects of Levels of Immersion and Points of View on the Reception of Scientific Content in Immersive Learning Videos
Sina Belschner	AI in the classroom - developing courses for future teachers in language and STEM subjects
Nele Theuer	Out of Sight, Out of Mind? Transcontextual Reference-Group Effects on Student Satisfaction
Hannah Deininger	Understanding Learning Processes and Their Influence on Achievement With Multimodal Data
Jana Kemmler	Motivational Support as a Key for Navigating Complex Learning Processes of AI-Literacy
Lucy Haag	Understanding the gender gap in economic and financial literacy
Jaeyoon Choi	Investigating Bias in Large Language Model for Role Identification in Collaborative Problem Solving
Fabian Stöhr	Leveraging Fine-Tuned LLMs in RAG Systems to Identify Counterfactual Causality Frameworks in Two Decades of Sociological Research
Daniela Verratti-Souto	Evaluating the Affordances of LLM for Enhancing Rule-Based Chatbots for Task-Based Language Teaching

Friday, October 18th, 2024
10:00pm – 11:00pm

Name	Title of Poster
Mats Abrahamse	Exploring the Role of Knowledge in the Effect of Age on Epistemic Curiosity
Evelyn Schnaufer	Learning Outcomes and Characteristics of Students in the Upper-Secondary Level in Baden-Württemberg
Fanyi Zeng	Exploring Pathways to Thriving: Latent Profile Analysis (LPA) of College Students' Motivational Strategy Use and Associations with Success and Wellbeing
Richard Schulte	Drill-and-Practice Tools in the Wild: Investigating Mathematics Teachers' Beliefs and Practices in the Use of MatheBattle
Franziska Tschönhens	Does Segmenting Work? Enhancing Pre- Service Teachers' Professional Vision
Ignatios Charalampidis	Exploring the Use of Linguistic Complexity Analysis in Second Language Aqcuisition (SLA) Applications
Nelly Sagirov	Automatic Extraction of Linguistic Features from English Texts
Dan John	Development of STEM self-concept and motivation in gifted children – Formation of STEM identities
Victoria Vochatzer	Missing effect(s) of an inquiry-based learning environment on students' competence development in secondary economic education

Association Research Talks

Thursday, October 17th, 2024

04:45am – 05:45pm

Forum 1

Name	Title of Talk
Evelyn Schnaufer	Learning outcomes and characteristics of students in the upper-secondary level in Baden-Württemberg
Ann-Marie Buchmann	What can we learn from the TOSCAneo study for an improvement of math teaching?
Noel Wytopil	Evaluating a Gifted and Talented Program Selection Process

Forum 2

Name	Title of Talk
Yannan Gao	A Leaky Pipeline or A Busy Highway? Developmental Patterns and Antecedents of Men's and Women's STEM Career Paths
Richard Schulte	Perspectives of Teachers and Students on Drill-and-Practice Technologies: Examining the Use of MatheBattle
Luisa Ribeiro-Flucht	Enhancing Language Learning with AI: A Personalized Dialogue-Based Approach to Second Language Acquisition

Forum 4

Name	Title of Talk
Nina Udvardi-Lakos	Developing Adaptive Online Professional Development Courses for Teachers
Behnaz Kiani	Development of Ecological Momentary Assessment (EMA) Scales for Assessment of ADHD in Preschool and Elementary School Children
Eleni Kanli	[motion verb + a/de + noun] Pedagogical Construction Grammar and Multilingual Didactics in Spanish Classes at German Grammar Schools

Forum 5

Name	Title of Talk
Marcel Capparozza	Facilitating Professional Knowledge for Technology Integration: Opportunities of Informal and Formal Learning Activities
Sophia Richardon	Giftedness, Learning Processes, and Empathy
Zachary Adolph Niese	Helping people find and develop genuine interests

Forum 6

Name	Title of Talk
Mats Abrahamse	Curiosity across the lifespan
Fanyi Zeng	Student Pathways to Thriving in College: Examining Self-Regulation Profiles with Multiple Data Sources
Seyma Gülen	tba

Special Interest Groups

Thursday, October 17th, 2024

11:20am – 12:20am

Name	Title of SIG	Place
Rebecca Beiter	Science Communication & Public Engagement	Forum 1
Thorben Jansen	Working with EdTech Companies to Conduct (Randomized) Studies	Forum 2
Aditya Singh	Democratic Schools: The Future of Education or Empty Promises?	Forum 4
Iris Backfisch, Marcel Capparozza and Franziska Tschönhens	Communicating and shaping evidence-based practice in the classroom. Do Meta-Analyses Hold the Answers?	Forum 5
Hubert Mayer	CS Teaching Competence Frameworks	Forum 6

LEAD
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PhD Talks

Friday, April 19ᵗʰ, 2024

11:00 am – 12:00am

Forum 1

Name	Title of Talk	Place
Soroosh Akef	Studying the role of L1 in characterizing Portuguese L2 proficiency using machine learning	Forum
Tosca Daltoè	The Assessment of Teaching Quality Through Classroom Observation – New Approaches for Teacher Education and Research	Forum

Forum 2

Name	Title of Talk	Place
Xinru Yao	Neurocognitive correlates of multi-digit arithmetic: an fNIRS study.	Forum
Alexander Jonas Jung	Students' Impact on Teachers and Teaching	Forum

Forum 4

Name	Title of Talk	Place
Julia-Kim Walther	Modifying the Wide Format Approach to Multilevel Structural Equation Modeling to Mitigate Estimation Problems	Forum

Studying the role of L1 in characterizing Portuguese L2 proficiency using machine learning *by Soroosh Akef (PhD)*

Language transfer, whereby a learner's L2 is influenced by their L1, has inspired the need for L1-specific criterial features to assess proficiency. This study addresses whether linguistic complexity and accuracy measures differ in their capacity to serve as criterial features for Portuguese L2 learners from different L1 backgrounds. Using the COPLE2 corpus and the CTAP complexity analyzer, we automatically extracted a broad set of complexity and accuracy measures from the written productions of Portuguese L2 learners from three different L1s: Chinese, Spanish, and Italian.

We subsequently trained L1-specific and L1-agnostic proficiency classifiers and performed cross-L1 tests. Our results indicate that L1-specific models generalize poorly to other L1s, highlighting the influence of L1 in proficiency classification. Analysis of the top features confirmed distinct patterns of complexity and accuracy across L1s, further underscoring the relevance of L1 in characterizing L2 proficiency.

These findings emphasize the importance of L1 in characterizing L2 proficiency, with implications for developing personalized language learning tools and tailored teaching approaches.

The Assessment of Teaching Quality Through Classroom Observation – New Approaches for Teacher Education and Research *by Tosca Daltoè (PhD)*

Teaching quality is a critical factor in student success, making its accurate assessment essential for both teacher development and educational research. Classroom observations are a common method for assessing teaching quality, yet they are subject to limitations like rater bias, which can compromise the psychometric quality of these assessments. To address this, classroom videos are increasingly used as representations of teaching practice, helping train observers and teachers to evaluate key aspects of teaching quality more reliably. In this talk, I will provide an overview of my dissertation, which explores innovative strategies for utilizing classroom videos to enhance the accuracy of observation-based assessments of teaching quality. This includes examining a video-based teacher training program for classroom observations and investigating the potential of immersive 360-degree video environments. I aim to emphasize the broader contributions of this research and welcome critical feedback as I prepare for my extended summary and defense.

Title tba *by Xinru Yao (PhD)*

Abstract tba

Forum 2

Students' Impact on Teachers and Teaching *by Alexander Jonas Jung (PhD)*

Traditionally, researchers interested in teaching assess how teachers' behaviors and characteristics affect student outcomes such as students' motivation and academic achievement. Teaching, however, occurs in dynamic social contexts that are not only shaped by teachers but also by groups of students that actively participate, disrupt, or ignore their teachers. Research on how students influence teaching processes is still in its early stages but is crucial for a coherent understanding of learning-teaching dynamics.

In this talk I will present findings from two exploratory and two confirmatory studies aimed at addressing this gap in the literature. In study one, we surveyed over 100 teachers using open-ended questions to identify which student characteristics impact their teaching, motivation, and emotions. In study two we conducted 540 Random-Intercept Cross-Lagged Panel Models between a range of student-rated and teacher-rated scales to explore patterns of reciprocal influences between students and teachers. In study three, we used Cross-Lagged Panel Models to analyze the longitudinal relationship between teacher-rated enthusiasm for teaching and student-rated interest across three datasets. Finally, in study four, a quasi-experiment assessed whether different student groups influence various measures of teaching quality, as rated by both teachers and students.

Forum 4

Applying the Wide Format Approach to Multilevel Structural Equation Modeling to Mitigate Estimation Problem*s by Julia-Kim Walther (PhD)*

In psychology and the education sciences, observational units are often nested within higher level units, such as students within classes. A powerful tool for estimating parameters across these different levels is multilevel structural equation modeling (SEM). Multilevel data can be arranged in two data formats, long (LF) and wide (WF) format, and for both, multilevel SEM approaches are available. While both approaches are implemented in the lavaan package in the free statistical software R, the major advantage of the WF approach is its adaptability. Within my dissertation, I first demonstrate that (1) both approaches result in comparably accurate models under small sample conditions. Building on this, I show that the WF approach can be modified to mitigate estimation problems (2) under small sample conditions, and (3) when heterogeneous variance components are concerned. Findings suggest that the extensions of the WF approach offer a robust and accessible avenue for researchers dealing with multilevel data, particularly when data acquisition is limited or populations are heterogeneous.