DAY OF RESEARCH

3. EDU Colloquium

25th February 2025
9.00 am - 3.30 pm

6th floor
Marsstraße 20-22

Programme

EDU Colloquium on 25.02.2025

		Lecturer	Guest-Supervisor
9.00 Uhr	Welcome and presentation of the program		
9.20 Uhr	Is Counting a Bad Idea? Complex Relations Between Children's Fraction Knowledge, Eye Movements, and Performance in Visual Fraction Comparisons	Sabrina Schwarzmeier	Prof. Enkelejda Kasneci
10.00 Uhr	Evidence-Based Advancement of Teaching AI in K-12: An Action Research Approach	Franz Jetzinger	Prof. Andreas Obersteiner
10.40 Uhr	Coffee break		
11.10 Uhr	Mathematics Teachers' Competencies in Digitally-Enriched Learning Settings	Alina Kadluba	Prof. Andreas Vorholzer
11.50 Uhr	Lunch Break		
12.50 Uhr	Poster-Session		
13.45 Uhr	Coffee break		
14.00 Uhr	Investigating the Role of Computing Education for Informed Decision-Making Regarding Digital Systems	Luisa Gebhardt	Prof. Manuel Förster
14.40 Uhr	SES and Student Achievement in Times of Crisis: A Meta-Analytical Examination of PISA 2018 and 2022	Maren Müller	Prof. Doris Holzberger
15.20 Uhr	Farewell		

Organizational Information

Presentations

The presentations will be given by PhD students and will be in German and English. The language of the presentation corresponds to the language of the title and abstract.

Each presentation will last 15 minutes, followed by 2 minutes to discuss what you have heard with the person sitting next to you. This is followed by a question and answer period. The discussion concludes with a 5-minute comment from the guest supervisor to wrap up the discussion.

Link to MURAL: https://shorturl.at/fCtRn

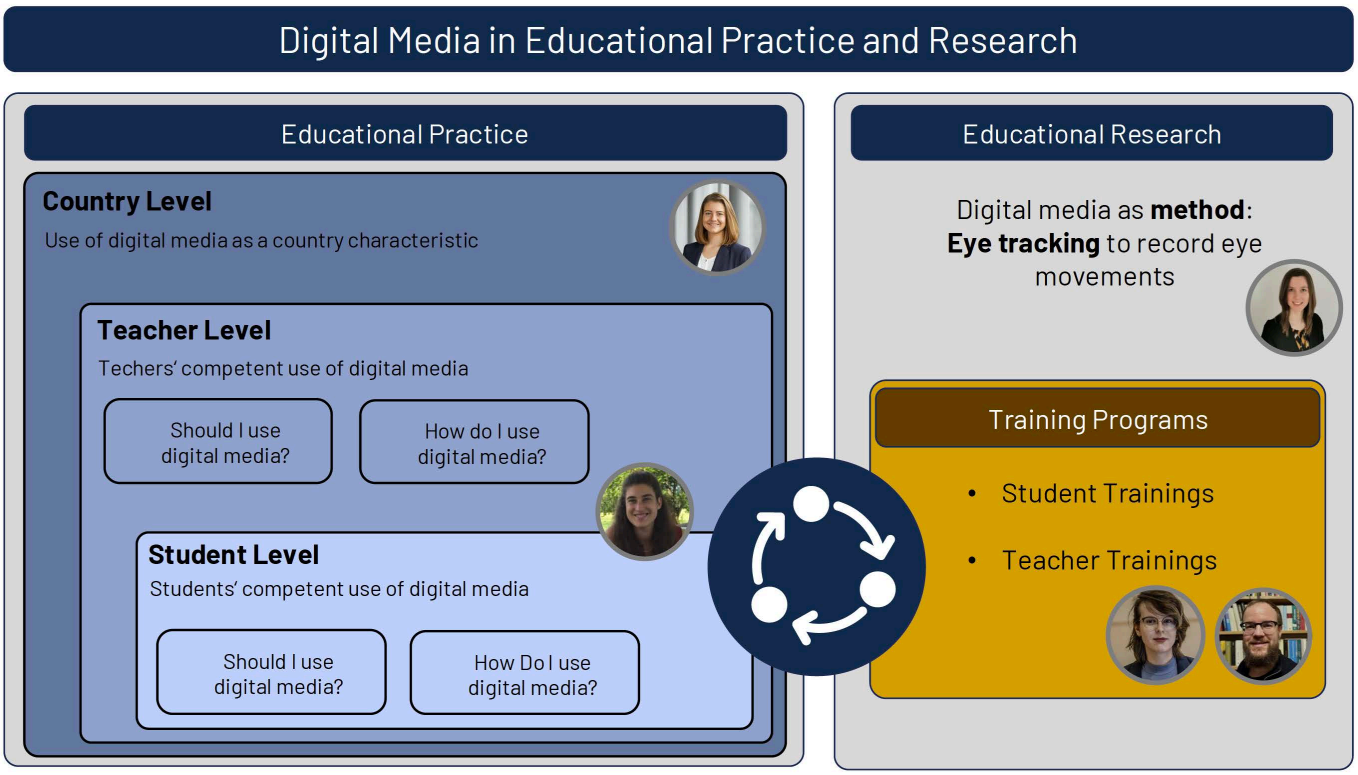
Postersession

All researchers in the Department of Educational Sciences are invited to present their research projects in the poster session. The poster session begins with short pitches of the posters in plenary. Afterwards, discussions can take place in front of the posters.

Contact

If you have any questions about the organization, please contact
Simon Munk (simon.munk@tum.de).

What Do the Five Presentations Have in Common? A Map For Orientation



“Is Counting a Bad Idea? Complex Relations Between Children's Fraction Knowledge, Eye Movements, and Performance in Visual Fraction Comparisons“

Sabrina Schwarzmeier

Chair: Mathematics Education
Supervisor: Prof. Andreas Obersteiner
Guest-Supervisor: Prof. Enkelejda Kasneci

Abstract

Understanding fraction magnitudes (i.e., the numerical sizes of fractions) is important for mathematical development but difficult for many children. Visualizations, such as tape diagrams, may be helpful for understanding fraction magnitudes because they address early proportional reasoning skills. However, depending on prior knowledge, these visualizations may encourage different strategies. Children with lower knowledge about fractions might rely more on counting strategies, which could lead to a natural number bias, whereas children with higher knowledge might process visual magnitudes using magnitude-based strategies and thus more efficiently. This study investigates the relationship between the general fraction knowledge of N = 67 students and their ability to visually compare fraction magnitudes. Participants completed a fraction knowledge test and 40 comparison tasks using tape diagrams, while their eye movements, accuracy and response times were recorded. A cluster analysis revealed three groups. The first group, which had high knowledge of fractions and used magnitude-based strategies, had high accuracy and short response times, indicating efficient strategy use. The second group with high knowledge used counting strategies unexpectedly often. This group achieved the highest accuracy but the longest response times, indicating inefficiency. The third group, which had little knowledge and rarely used counting strategies, had the lowest accuracy and short response times, but compared absolute rather than relative sizes. None of the groups exhibited a natural number bias. The study suggests that although counting is inefficient, it does not necessarily lead to bias or poor performance. Instead, a bias can arise from looking at absolute sizes.

“Evidence-Based Advancement of Teaching AI in K-12: An Action Research Approach”

Franz Jetzinger

Professorship: Computer Science Education
Supervisor: Prof. Tilman Michaeli
Guest-Supervisor: Prof. Manuel Förster

Abstract

In recent years, artificial intelligence (AI) has evolved from a trendy topic to an integral part of our daily lives. To empower students to shape their future, it is therefore crucial that they are enabled to analyse and discuss the consequences, opportunities and limitations of AI's impact on society. Consequently, AI-related competencies are being introduced in K-12 computer science (CS) curricula across the globe. Furthermore, a plethora of pedagogical resources and approaches to teaching AI have been developed in recent years. However, in educational research, we still lack an understanding of the problems teachers and students face in the classroom. To address this gap, we conduct an action research project with the goal of developing theories about teaching and learning processes in the field of AI. The first action research cycle focused on identifying students’ (AI-specific) learning challenges. Fourteen CS teachers participated in the project, teaching in 26 CS classes in Bavarian high schools. There, AI was introduced within an existing mandatory CS subject in year 11. This presentation will illustrate the design of this first cycle, demonstrate its findings, and provide insights into the development of theories that form the foundation for an evidence-based advancement of teaching AI.

“Mathematics Teachers’ Competencies in Digitally-Enriched Learning Settings”

Alina Kadluba

Chair: Mathematics Education
Supervisor: Prof. Andreas Obersteiner
Guest-Supervisor: Prof. Andreas Vorholzer

Abstract

Integrating digital technology into mathematics education can significantly improve student learning, but its effectiveness depends on how it is implemented. Teachers’ technological pedagogical content knowledge (TPACK) of how to use digital technology effectively and their practical implementation therefore play a crucial role. This presentation provides an overview of how mathematics teacher knowledge has been assessed in previous studies and explores its impact on technology integration and student learning.

Three studies that link teachers’ professional knowledge, instructional practices, and student learning in digitally-enriched learning settings will be presented. The first study, a systematic literature review of 123 studies, indicates that TPACK is often assessed using self-report scales rather than objective knowledge tests. In addition, many assessments are rather unspecific in terms of content, referring to mathematics in general without specifying content areas. The second study of 173 mathematics teachers shows that these commonly used self-report scales are not very reliable for assessing TPACK because there is little correlation between self-reported and objectively assessed knowledge. The third study, involving 14 teachers and 367 students, shows that teachers’ professional knowledge strongly influences how they implement digital tools, which in turn affects student learning. In addition, this study indicates that content-focused technology integration plays an important role in successful implementation.

Overall, the findings highlight the importance of accurate TPACK assessment and content-specific approaches to digital technology use. This research underscores that the impact of digital tools on learning is not simply a matter of their presence, but of how effectively they are aligned with content and educational practices.

“SES and Student Achievement in Times of Crisis: A Meta-Analytical Examination of PISA 2018 and 2022”

Maren Müller

Working Group: Center for International Student Assessment (PISA)
Supervisor: Prof. Doris Lewalter
Guest-Supervisor: Prof. Doris Holzberger

Abstract

The effects of the measures taken to contain the COVID-19 pandemic have been analysed in numerous scientific studies. Pupils recorded significant performance losses in maths and reading during the pandemic. In particular, achievement disparities attributable to socioeconomic status (SES) may have been significantly exacerbated, as low-SES families often did not have the necessary resources to adequately support children and adolescents during school closures and periods of remote learning.
The aim of this study is to investigate the extent to which different characteristics of countries can explain possible changes in the relationship between SES and competences by comparing data from 34 OECD countries. A new meta-analytical procedure will be used to examine whether the influence of SES on learners' competences has changed between the two survey dates. The second step is to identify potential moderators that can explain the expected variance in the relationship between SES and competences between the states.
A particular focus is on pandemic-related factors, operationalized with the COVID Stringency Index, as well as other country-specific moderators such as the degree of digitalisation, the national level of prosperity and the quality of teacher training. The aim of the study is to shed light on the dynamics of socio-economic disparities in educational success during global crises and to investigate the role of specific national contexts in reinforcing or compensating for these effects.

“Investigating the Role of Computing Education for Informed Decision-making Regarding Digital Systems”

Luisa Gebhardt

Professorship: Computer Science Education
Supervisor: Prof. Tilman Michaeli
Guest-Supervisor: Prof. Manuel Förster

Abstract

Computing education has the task of enabling students to make informed decisions as responsible citizens - especially about the use of digital systems in everyday life (informed usage decisions): Although the features of many digital systems, such as various social networks or smart home systems, appear similar, there are fundamental differences in how they work and their effects. To be able to make an informed usage decision between several systems, it is necessary to choose from the available alternatives based on one's own goals and values.

To do this, computing competencies are required, as the following example shows: If you want to decide between several social media services, you can consider many different goals and values. For example, if freedom and independence are particularly important to you with such services, it is not enough to simply pay attention to the design or user experience: It needs to be clarified who has access to personal data, who can delete content and ban users, so ultimately who has the power in this system and whether they can be trusted. In order to answer these questions, knowledge about data storage, encryption, but also the architecture of the system and the operator is required. So far, the focus of computing education research has been on how digital systems are explained, how they are presented, or how their consequences are assessed - but not on how this knowledge is used to make decisions. This PhD project investigates the role of computing education in making informed usage decisions regarding digital systems, the obstacles students face when applying computing competencies in the decision-making process, and how computing competencies can be promoted for making informed decisions.