

## **Interactive poster session (organiser: Michael Komorek)**

Title of the session:

### **Understanding out-of-school learning processes in STEM disciplines within the graduate program GINT**

Bliesmer, Kai; Komorek, Michael; no. 4368427; Educational Reconstruction of currents and structure formations

Gorr, Claudia; Michelsen, Claus; Komorek, Michael; no. 4367395; The system behind climate. Cognitive and motivational processes in the development of climate system understanding throughout a sequence linking in-school and out-of-school-learning.

Jansen, Annegret; Krause, Ulrike; no. 4365373; Adolescents' reasoning and judgement about complex problems in sustainable development: an intervention study

Janssen, Sönke; Friege, Gunnar; no 4364726; Improving science out-of-school lab in a design based research approach

Komorek, Michael; Sajons, Christin; no. 4368561; Complementary networking of out-of-school learning environments

Müller, Swantje; Pietzner, Verena; no. 4346411; Divergent thinking of students taking part in science competitions

Roskam, Annika; Bliesmer, Kai; Komorek, Michael; no. 4368618; Climate change and the physical dynamics of coast, wadden sea and ocean as topics for extracurricular learning

Sajons, Christin; Komorek, Michael; no. 4366490; Understanding pupils' learning processes in out-of-school science labs

Striligka, Anastasia; Stavrou, Dimitrios; no. 4366600; An empirical study on learning processes and actions of students while interacting with exhibits at a science center

Winkelmann, Micha; Wessnigk, Susanne; no. 4364600; Interest structured learning processes in the out-of-school lab "NILS"

### **Structure of the session**

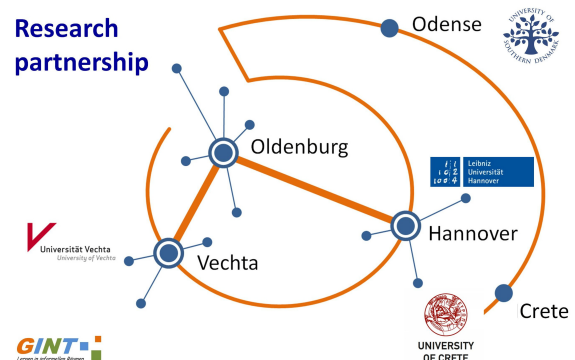
The 90-minute poster session is structured as follows:

- 5 minutes introduction by the program speaker (Komorek)
- 10x 3 minutes oral presentation of each poster by the poster authors
- 25 minutes of in-depth discussion between the poster authors and the audience at the posters
- 10 minutes comment by the discussant (who received the posters three weeks before the Conference) (Igal Galili is requested)
- 15 general discussion with the audience (moderated by the program speaker) about the program's approach, the methods and the results so far

## Background of the interactive poster session

**The graduate program GINT:** In 2016, the graduate program "STEM-Learning in Extracurricular Learning Environments and their Integration into Regional Learning Contexts (GINT)" has started. The program is funded by the Lower Saxony Ministry of Science and Culture. It is run by the University of Oldenburg in cooperation with the Universities of Hannover, Vechta, Odense (Denmark) and Rethymno (Greece). More than twenty extracurricular educational institutions, student labs, regional environmental education centers, Wadden Sea houses, energy training centers, coastal research institutes, and museums are associated with the program.

A total of twelve Georg Christoph Lichtenberg scholarships have been granted. Another four doctoral students with related topics joined the program. Doctoral students from geography education, computer science and technology education, natural sciences education, philosophy education as well as from educational sciences are involved. They deal with the research of extracurricular subject-specific learning offers in the participating disciplines. They investigate how learning takes place in extracurricular learning environments in detail and how the offerings of an educational region could be networked and developed by integrating out-of-school learning opportunities into school curricula. Further information is available at <https://www.uni-oldenburg.de/gint/>.



The program implements a comprehensive qualification concept. Three-day workshops twice a year, regular seminars on core topics and research methods, small-scale work on data analysis and external lectures are provided. Additionally, a systematic presence of the doctoral students at conferences and an introduction to publication activities are supported.

**Characteristics and modeling of extracurricular GINT learning processes.** There is a long list of expectations associated with the constructed extracurricular learning environments (Tal, 2012). It is suspected that children and adolescents learn freer and more self-determined, more effective, according to their interests, and thus more authentic, more phenomenologically oriented, more application-oriented, more context-oriented and in a more sustainable way than at schools (see Hobbensiefken 2010). In particular, it is expected that free experimentation situations have these characteristics. To what extent and which learning processes actually take place at extracurricular GINT learning environments has not been investigated empirically in a sufficient way yet (Clausen, 2015; see also Schmidt, Di Fuccia & Ralle, 2011).

At least in Germany, the idea of informal learning is still hardly established (BMBF, 2001), even though it enjoys relatively high international importance (BMBF, 2001, 2005; Stockmayer, Rennie & Gilbert, 2010). Especially, the OECD tries to disseminate informal learning activities by projects like "Recognition of non-formal and informal learning" (Cross, 2007; OECD, 2013). In most cases, informal learning do not describe the structuredness of the learning processes themselves, but rather the extent of the structuredness of the learning environment. This can be explained by the fact that under a constructivist learning paradigm (Gerstenmeier & Mandl, 1995), in which learning processes are highly individualized (but not arbitrary), as well as under an instructional paradigm. There is a close linkage between the structuredness of the learning environment and the learning processes. In addition, there is an unspoken hypothesis that informal learning is self-determined, varied and therefore differentiable, free from pressure to perform and authentic (see BMBF, 2001, 2005; Zürcher, 2007; Cross, 2007).

**Research questions within the graduate program GINT.** The considerations above lead to a broad spectre of research questions which the doctoral students work on and which is presented in the session:

- Characterization of learning environments: How to characterize out-of-school learning environments from a learn-theoretical point of view? Which learning processes can potentially and actually take place against the background of basic models of learning? Which equipment is available and which formats

are realized at the out-of-school-learning programs? What are the goals of the leaders of the learning places?

- Learning prerequisites: Which prerequisites (interests, knowledge, motives, experiences) of the students have a significant influence on their learning processes at the extracurricular learning environments?
- Motivation and learning: How to assess the relationship between increasing interest and motivation to content-related learning processes against the background of the goals of extra-curricular learning places (comp. Deci & Ryan, 2008)? How is long-term learning that does not lead to 'passive' or 'inert' knowledge supported? How do students perceive their visit to the extracurricular learning location? How do they rate the environment, equipment, and personnel?
- Learning processes: Which processes of perception, thinking, learning, problem-solving, etc. take place in extracurricular learning environments and how can they be modeled? Which subject-related and interdisciplinary learning processes take place and how are they promoted or inhibited? How do knowledge, abilities, attitudes of students develop by visiting the out-of-school learning place?
- Education for Sustainability: To what extent is awareness raised for questions of sustainable development? To what extent can the concrete learning offering (for example in the field of energy, coastal protection, the dynamics of the Wadden Sea, bird migration, regional development) contribute to raising awareness?
- Development of extra-curricular learning environments: To what extent can existing offerings be developed? How can differentiated learning environments be designed that take account of heterogeneity according to various characteristics such as achievement, previous experience, interest, gender, ethnic-cultural background, self-efficacy, etc.?
- Extracurricular and school learning: What are the goals of the school or teacher visiting the extracurricular learning location? How can phases of informal learning be effectively and efficiently integrated into school lessons (Braund & Reiss, 2007; Schmidt, Di Fuccia & Ralle, 2011)? To what extent is the visit designed for the requirements of the school lesson? How can knowledge about extra-curricular learning be used to improve STEM teaching in school? What is the relationship between the school and the extracurricular learning places? And is a learning collaboration developing?

## References

- BMBF (Hrsg.) (2001). *Informelles Lernen – Die internationale Erschließung einer bisher vernachlässigten Grundform menschlichen Lernens für das lebenslange Lernen aller*. Bonn: BMBF.
- BMBF (Hrsg.) (2005). *Stand der Anerkennung non-formalen und informellen Lernens in Deutschland im Rahmen der OECD Aktivität „Recognition of non-formal and informal Learning“*. Bonn: BMBF.
- Braund, M. & Reiss, M. (2007). Towards a more authentic science curriculum: The contribution of out-of-school learning. *International Journal of Science Education* 28(12), 1373-1388.
- Clausen, S. (2015). *Systemdenken in der außerschulischen Umweltbildung – eine Feldstudie*. Münster: Waxmann.
- Cross, J. (2007). *Informal Learning. Rediscovering the natural pathway that inspire innovation and performance*. San Francisco: Pfeiffer.
- Deci, E. L., & Ryan, R. M. (2008). Self-determination theory: A macrotheory of human motivation, development, and health. *Canadian Psychology*, 49(3), 182-185.
- Gerstenmaier, J. & Mandl, H. (1995). *Wissenserwerb unter konstruktivistischer Perspektive*. Zeitschrift für Pädagogik 41, 6, 867-888.
- Hobbensiefken, G. (2010). *Analyse von physikorientierten Konzepten für außerschulische Lernorte*. Bachelor-Arbeit. Oldenburg: Universität.
- OECD (2013). *Recognising Non-Formal and Informal Learning: Outcomes, Policies and Practices*. New York: OECD-Press.
- Schmidt, I., Di Fuccia, D. S. & Ralle, B. (2011). *Außerschulische Lernstandorte – Erwartungen, Erfahrungen und Wirkungen aus Sicht von Lehrkräften und Schulleitungen*. MNU 64 (6), 362-369.
- Stocklmayer, S. M., Rennie, L. J. & Gilbert, J. K. (2010). The roles of the formal and informal sectors in the provision of effective science education, *Studies in Science Education*, 46 (1), 1-44.
- Tal, T. (2012). *Out-of-School: Learning Experiences, Teaching and Students' Learning*. In: B. J. Fraser, K. Tobin & C. J. McRobbie (Eds.), *Second International Handbook of Science Education* (S. 1109-1122). Heidelberg: Springer.
- Zürcher, R. (2007). *Informelles Lernen und der Erwerb von Kompetenzen: Theoretische, didaktische und politische Aspekte*. Materialien zur Erwachsenenbildung. Wien: BUKK.