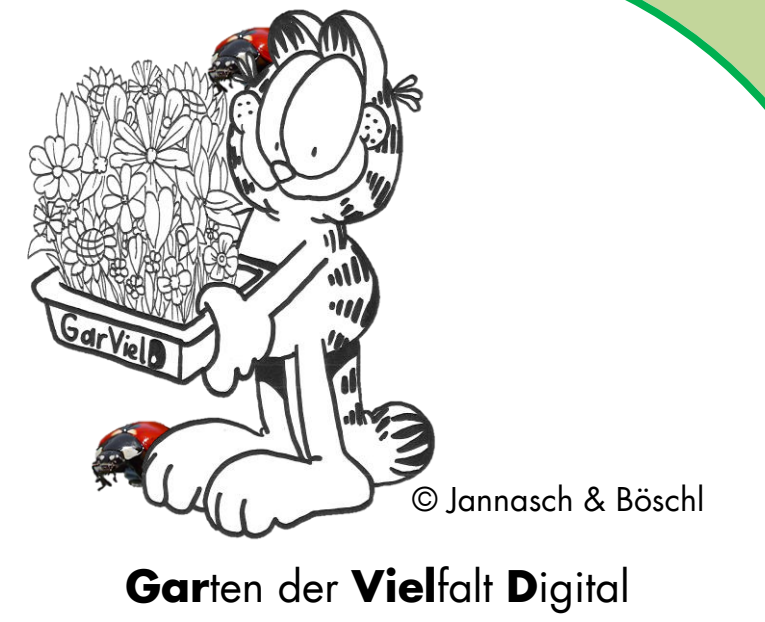




Biodiversity in a Campus-School garden



A citizen science approach with students and elementary school children

Biodiversity

- "Biological diversity" means the variability among living organisms from all sources including, *inter alia*, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems." (CBD 1992)
- Definition of 'biodiversity' according to a common biology textbook: *biological diversity with three general levels of analysis – genetic diversity, diversity of species and diversity of ecosystems* (c.f. Reece et al. 2016)
- General knowledge and understanding of ecosystems, animal-plant-interactions and relations of species extinction or ecosystem functions such as pollination, reflect an important biological relevance for humans' living conditions
- In general, the concept of biodiversity is often poorly understood, however at the same time the society has a high responsibility for the protection of biodiversity as the decline of species diversity is mainly caused by mankind (CBD 1992; Menzel & Bögeholz 2009)

School garden

Provide original experiences

- Children's increasing alienation from nature causes a decrease in their knowledge of plant species (Lindemann-Matthies 2006; Benkowitz 2014)

Fulfill obligations

- *Learning in school gardens holds particular importance* (BMBU 2007)
- *Through the experience of nature's variety and uniqueness students develop a sense for its beauty and the necessity of an attentive handling* (SMK 2009)
- *Encountering plants and animals is subject of one third of elementary science lessons e.g. in the curriculum in Saxony, Germany* (SMK 2009)

Generate learning efficacy

- Elementary school children feature a comparatively great interest in animals and plants (Kattmann 2000; Balmford et al. 2002; Berck 2009)
- The further encouragement of children's interest development requires settings that aim for active learning processes (Hartinger 1995)
- Outside activities in original habitats have a positive impact on the acquisition of species knowledge (Killermann & Scherf 1986; Bögeholz 1999; Lude 2001) and are, therefore, the most effective and from children's perspective most popular opportunities for teaching biodiversity and species knowledge (Lindemann-Matthies 2006)
- School garden experience is supposed to have a significant positive influence on the awareness of different animal and plant species and therefore might lead to an increased need to protect biodiversity (Benkowitz 2014)

Citizen Science

- Citizen science could be defined as "a combination of authentic research and public education as a 'win-win'-situation" (Dickinson et al. 2012)
- It offers next to a transparency of data records and current research topics the chance to generate specific data sets (e.g. explicitly big or extraordinary)
- Project extent can vary in time, space, topic, complexity and manpower
- Research about citizen science in schools and universities is still in its very early stages (Bonn et al. 2016)
→ however there are already some studies for elementary schools showing positive long-term learning success (Hirschenhausen et al. 2017), useful data on ecosystem function research (Miczajka et al. 2015) and benefits for cross-curricular teaching and species knowledge (Ulbrich et al. 2017)

Hypothesis

We expect the use of a citizen science based learning environment to have a more positive effect on the content knowledge of teacher trainees compared to control with common teaching methods in consequence of an increased motivation due to the nature of citizen science – these benefits can also be transferred to elementary school children.

Method

- Pre/post evaluation of lectures on biodiversity about content knowledge, motivation and self-determined learning (c.f. Deci & Ryan 1993) gained through a citizen science project participation versus control group
- Develop a learning environment combining school garden and curriculum education with a citizen science project focus
- Establishing the learning environment with an included citizen science content with students for later elementary school transfer

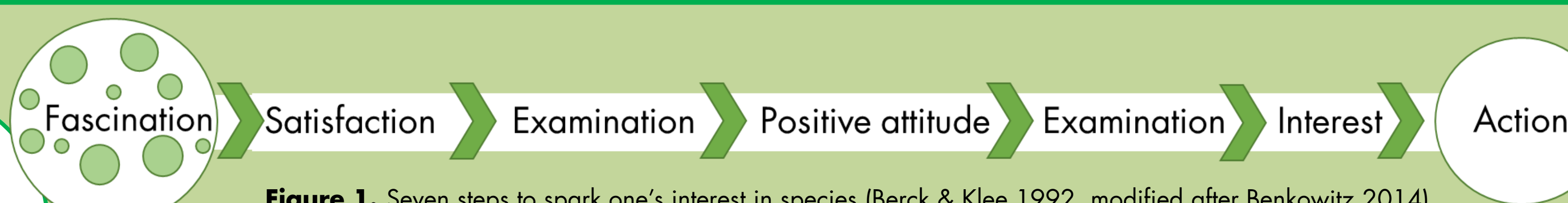


Figure 1. Seven steps to spark one's interest in species (Berck & Klee 1992, modified after Benkowitz 2014).

Practical approach

- Evaluate an existing project with a defined research focus: e.g. *changing species composition*
- Continue a successful research project that generated new questions with new research focus: e.g. *efficient slug defence for effective cafeteria experiments*
- Develop a new project with explicitly interdisciplinary generated research focus: e.g. *comparison of species geographical distribution or over time*



Figure 2. Different examples for a practical citizen science approach combining effective environmental education and research in natural and educational sciences (A) evaluate an existing project about changing lady bug compositions (B) continue a successful research project on slug defence (C) develop a new project investigating trap nests from different geographical regions.

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