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Biodiversity in a Campus-School garden

A citizen science approach with students and elementary school children

Garten der **Viel**falt **D**igital

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 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 natures' 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 extraordinaire)
- 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 – theses 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).

Figure 2. Different examples for a practical citizen science approach combining effective environmental education and research in natural and educational sciences (A) evaluate an exisitng 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 georaphical regions.

Practical approach

A) Evaluate an existing project with a defined research focus: *e.g. changing species composition*

B) Continue a successful research project that generated new questions with new research focus: *e.g. efficient slug defence for effective cafeteria experiments*

C) Develop a new project with explicitly interdisciplinary generated research focus: *e.g. comparison of species geographical distribution or over time*

References

Balmford, A., Clegg, L., Coulson, T. & Taylor, J. (2002). Why conservationists should heed Pokémon. Science, 295(5564), 2367. | Benkowitz, D. (2014). Wirkung von Schulgartenerfahrung auf die Wahrnehmung pflanzlicher Biodiversität durch Grundschulkinder. Schneider Verlag Hohengehren GmbH. | Berck, K.-H. (2009). Artenkenntnisse wozu - Naturbegegnung was ist das? Ein Abgesang auf den Biologieunterricht? Der mathematische und naturwissenschaftliche Unterricht (MNU), 62(2), 68-71. | BMBU Bundesministerium für Umwelt, Naturschutz, Bau und Reaktorsicherheit (2015). Nationale Strategie zur biologischen Vielfalt. 4. Aufl. | Bögeholz, S. (1999). Qualitäten primärer Naturerfahrung und ihr Zusammenhang mit Umweltwissen und Umweltthandeln. Leske & Budrich, Opladen. | Bonn, A., Richter, A., Vohland, K., Pettibone, L., Brandt, M., Feldmann, R., Goebel, C., & et al., (2016). Grünbuch Citizen Science Strategie 2020 für Deutschland. UFZ Leipzig, iDiv Halle-Jena-Leipzig, MfN Berlin, Leibniz-Institut für Evolutions- und Biodiversitätsforschung, BBIB Berlin. | CBD Convention on Biological Diversity (1992). Convention on Biological Diversity. Rio de Janeiro: UNCED. | Deci, E.L., & Ryan, R.M. (1993). Die Selbstbestimmungstheorie der Motivation und ihre Bedeutung für die Pädagogik. In: Z. f. Päd. 39(2), 223–238. | Dickinson, J.L., Shirk, J., Bonter, D., Bonney, R., Crain, R.L., Martin, J., & Purcell, K. (2012). The current state of citizen science as a tool for ecological research and public engagement. Frontiers in Ecology and the Environment, 10(6), 291-297. | Hartinger, A. (1995). Interessenentwicklung und Unterricht. Grundschule, 27(6), 27-29. | Kattmann, U. (2000). Lernmotivation und Interesse im Biologieunterricht. In: Bayrhuber, H. & Unterbruner, U. (Hrsg.): Lehren und Lernen im Biologieunterricht. – Innsbruck, S. 13-31. | Killermann, W. & Scherf, G. (1986). Erwerb pflanzlicher Formenkenntnisse mit Hilfe des Unterrichtsgangs und Verstärkung der schützenden Einstellung gegenüber Pflanzen durch formenkundlichen Unterricht. In: Hedewig, R. & Knoll, J. (Hrsg.): Biologieunterricht außerhalb des Schulgeländes. Aulis, Köln: 162-172. | Lindemann-Matthies, P. (2006). Investigating nature on the way to school: responses to an educational programme by teachers and their pupils. International Journal of Science Education, 28(8), 895-918. | Lude, A. (2001). Naturerfahrung und Naturschutzbewusstsein. Studienverlag, Innsbruck. | Menzel, S. & Bögeholz, S. (2009). The loss of biodiversity as a challenge for sustainable development: how do pupils in Chile and Germany perceive resource dilemmas?" Research in Science Education 39(4), 429–447. | Miczajka, V.L., Klein, A.-M., Pufal, G. (2015). Elementary school children contribute to environmental research as citizen scientists, PlosOne 10(11), 1-10. | Reece, J.B., Urry, L.A., Cain, M.L., Wassermann, S.A., Minorsky, P.V., Jackson, R.B., Campbell, N.A. (2016). Biologie. 10. Aktualisierte Auflage, Pearson, 1659. | SMK (Sächsisches Staatsministerium für Kultus) (2004/2009). Lehrplan Grundschule. Sachunterricht.