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# "Who wants to retain excellence needs continuous transformation": The Journey of a Science Education Centre in Austria

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Educational Action Research is not only an effective instrument for the development of teaching and the acquisition of educational knowledge, but also serves as a guiding philosophy for educational institutions in their continuous process of identity development and self-reflection. The example of an Austrian non-formal science education center shows in which dimensions this can be effective and gives an impression of how the idea of a continuous iterative development process can be shaped in practice.

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## Institutional context of the multidimensional action research approach

Since the foundation in 1997 the idea behind the "NaturErlebnisPark" in Graz has been to create a learning landscape in an urban environment in which ecological, spatial planning and educational objectives could be pursued equally. Building upon over the past two decades, an extracurricular educational institution has developed which works together with regional, national and international cooperation partners at the interface between science and education.

The central concern has remained unchanged over the years: We regard profound scientific knowledge, a reference to nature based on sensory experience and the promotion of critical faculties, curiosity, dialogue and creativity as important foundations for developing a mindful, committed and responsible approach to the world around us.

Over the years, a differentiated educational structure has developed which uses the public urban green space specifically as a place of scientific education and to act as an intermediary institution mediating between natural conditions, population, science and education system and supports the acquisition of scientific as well as personality building competences.

## Specific conditions of non-school educational institutions demand distinct action research approaches

Out of school institutions are under great pressure to constantly develop new product lines and adapt to rapidly changing conditions. At the same time, they pursue high standards with regard to the content, methods and pedagogical quality of the offers.

Non-formal offers for learning enrich the educational landscape and increasingly act as mediators between schools, science, business, the natural environment and the population. The strong call for the promotion of partnerships between formal and non-formal learning is also accompanied by the demand for profound theory building and impact research for this sector of education.

The work in the out-of-school setting often takes place under different conditions than classical school teaching. This presents both challenges and opportunities. A big advantage of the out-of-school place of learning is that it is possible to work across subjects independently of curricula. In this context complex topics can be viewed from different perspectives. Such institutions can provide staff, infrastructure and materials that schools do not usually have. At an out-of-school learning location, for example, special didactic materials can be produced, elaborately equipped learning environments can be designed and care-intensive teaching formats with different role models can be implemented. For out-of-school providers, a number of challenges have to be overcome: The program must offer attractive, unfamiliar access and experience for different target groups, otherwise there is no incentive for schools to book them. Since participation in the activities is voluntary, there is an increased need to motivate people attending activity programs.

Another aspect that needs to be taken into account is that the financing of out-of-school learning places often depends on specific priority programs of the funding bodies. Out-of-school learning venues are therefore dependent on continuously developing their offerings in order to meet the requirements of current developments in the education system and to adapt them to the needs of children in an attractive action-oriented manner.

## Action research-based iterative development approach

Facing these challenges during the last two decades the science education center NaturErlebnisPark underwent a series of enhancements. The actual approaches and methods used in the NaturErlebnisPark are the result of a continuous process of development and practical research which, according to Feldmann, Altrichter, Posch and Somekh (2018), can be


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described as a series of circular sequences of development, practical application, evaluation and interpretation.

In retrospect, the continuous development and practical research work can be divided into different phases, each of which is characterized by a self-image of the institution, an appropriate range of services and appropriate teaching approaches. In each of these phases, development work was confronted with a concrete challenge, which was overcome by means of evidence-based evaluation and accompanying research measures. The interpretation of the data obtained in this way and the conclusions drawn from it led again to a changed self-image and a further development of the teaching approach and range of offers.

Throughout all these phases there are lines of development that interact with each other and thus form a complex structure of sequences of the reflected developments, which are based on each other. **Figure 1** shows how three relevant lines of the development processes, namely - teaching methodology, the methodological design of accompanying research and the institution's self-conception - run through successive phases of institutional development.

- The teaching methods underwent a continuous increase in complexity and a constant differentiation and led to the development of a variety of specific teaching concepts adapted to the needs of different user groups (Grabner 2014, Frantz-Pittner 2014).
- As the complexity of the teaching offers increased, the questions of evaluation became more complex over the years and the development of context-specific research instruments was repeatedly necessary (e.g. Frantz-Pittner, Grabner, Bachmann & Reicher-Pirchegger, 2013).
- The continuous further development repeatedly required a reflective view of one's own position, values and objectives. In the sequence of the single development circles, core areas that determine identity were defined and specified and distinctive positions were sharpened in view of changing framework conditions.

In each of these lines we find a sequence of iterative action research processes that build on each other, which are flexibly aligned to the respective conditions by including further perspectives, increasing complexity, focusing on new focal points and sharpening the profile, but without losing their basic orientation.

## Phases of development of the science education centre "NaturErlebnisPark" – Reactions to changing conditions

Impulses for further development are generated on the one hand by external conditions and challenges, but also by the confrontation with new ideas and developments which resulted from intensive work with various trends and findings of the educational sciences. Knowledge and developments gained in action research processes were an important point of reference in order to be able to meet the respective challenges in a targeted manner.

The interaction between external framework conditions and the progressive acquisition of knowledge resulted in an ongoing process of change, which can be roughly divided into the following phases named according to the prevailing pedagogical concepts:

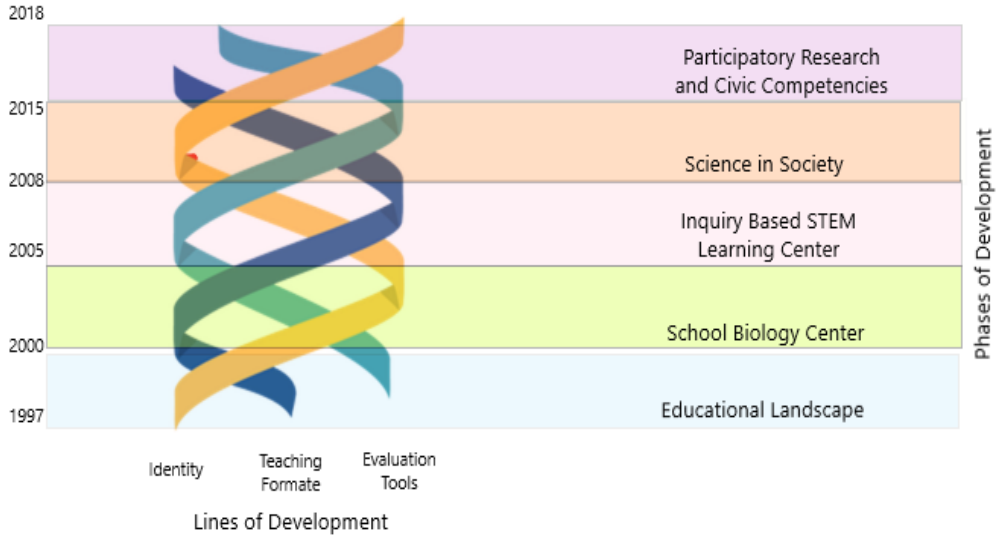


**Figure 1.** *Phases and Lines of Development of the Science Education Center NaturErlebnisPark*

### *Educational landscape*

In the beginning activities for children and adults were offered which were tailored to a newly designed natural space in a process of re-naturalization. The place itself was the content, the activities primarily aimed at perceiving the diversity of nature in the course of the seasons. The proponents of the institution, mostly biologists, were keen to pass on their own enthusiasm for the diversity of natural organisms and natural habitats. The focus should be less on expertise than on the process of discovery, perception and reflection. The children's programs were aimed at schools and as well at families or were offered as a leisure group ("junior researchers"). The central mediation method was that of "guided action walks": In the company of adults, the children roamed through a natural space and were encouraged and methodically supported to actively make their own discoveries and discover connections.

### *School biology centre*

It soon turned out that schools and kindergartens were by far the largest group of visitors. The subsequent decision to intensify the focus on school-based learning also led to a change of name

to "Schulbiologiezentrum NaturErlebnisPark" (School Biology Centre NaturErlebnisPark) in the year 2000.

With the clear positioning as an institution supporting subject teaching, a stronger focus was placed on the learning process of the children. The main focus got the communication of scientific concepts, ways of thinking and working. An intensive cooperation with local universities started. The range of services was no longer limited to on-site events but was expanded to include school visits and educational events for teachers. Research findings in teaching and learning as well as instructional theories were increasingly incorporated into program planning (e.g. Siebert 1999, Ollerenshaw, Ritchie & Rieder, 2000, Bullock & Ziegler 1999)

### *Inquiry based STEM learning*

Primary schools crystallized as the most important user group. Teachers gladly accepted the offers of the School Biology Centre as a support for their classroom teaching. Parallel to the activities for school classes, since 2005 a seminar program for teachers and teacher training students was offered under the title "Sachunterrichtsnetz" ("Primary science Network").

The increased involvement in communities of teaching development led to intensive engagement with theories of teaching and learning. Teaching concepts of didactic constructivism became increasingly important as a pedagogical basis.

The role of the anchor stories as an instrument to support situated learning and the consistent use of problem-oriented and inquiry - based teaching formats were intensified.

### *Science in society*

The integration into the Austrian "Science Centre Network" in 2008 enabled an intensive discussion of the relationship between science and society and the role of non-formal educational institutions in the promotion of scientific literacy.

In addition to local support of science teaching, the Science Education Centre "NaturErlebnisPark" was increasingly involved in national and international projects for the development and research of formats and methods of science communication (e.g. Fibonacci, http://www.fibonacci-project.eu/; Forschend Lernen, https://www.science-center-net.at/type-projekte/forschend-lernen/).

### *Participatory research and civic competencies*

The science education centre "NaturErlebnisPark" repeatedly assumed the role of an intermediary institution that mediated in educational consortia between institutions of business, research, administration and schools in order to enable the pupils to have a lifelike relationship to science and research. Key challenges at present are the active involvement of children into scientific projects, the development of approaches and methods concerning the UN sustainable development goals (United Nations, 2015) and the promotion of the 21`st century competencies (Dede, 2009).

At the same time, the relocation of the institution from the periphery to the central urban green space by the city administration offered the opportunity to address other target groups – children as well as adults- with low-threshold activities. These spatial conditions are consistent with the function as an intensive provider and coordinator of education in the city. On behalf of the Department for Urban Green Spaces of the city of Graz, the institution is specifically establishing the urban public greenyards as a place for science communication.

## Summary

What sets action research ahead of other research methodologies is that, beyond the generation of concrete findings and improvements, processes are initiated that can lead to transformations of an institution. A basic attitude of continuous reflection, the inclusion of different perspectives and a context-sensitive readiness for constant further development keep an institution in a vivid relation with its contextual framework through "iterative, continuous and flexible processes of adaptive learning"(Owen, Macnaghten & Stilgoe, 2013) taking place in circles of action, reflection and development.

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