Water education in Germany – An evaluation of the concepts applied

Carolin Rettig

Institute of Landscape Management
Tennenbacher Str. 4, III. OG,
79106 Freiburg
Germany
carolin.rettig@landespflege.uni-freiburg.de

ABSTRACT

Water plays a vital role in our lives and fulfils a multitude of ecological, social and economic functions. A carefully considered approach to water education is fundamental to raising public awareness and encouraging sustainable water resource management. The primary aim of this study was to evaluate the success of informal water education programmes by employing theoretical and empirical methods. The research outcomes are an overview of the existing approaches to water education in Germany and other countries, assessment criteria in accordance with modern cognitive psychology, and the assessment of specific water education concepts and their effectiveness.

KEY WORDS

assessment criteria, environmental awareness, sustainable water resource management, water protection

INTRODUCTION

There is general agreement around the world that water resources must be protected and managed sustainably (e.g., Kroiss, 2004; United Nations, 1992, 2003, 2006). Water fulfils a wide range of ecological and regulatory functions, for instance, in shaping landscapes, influencing the climate, and providing habitats for flora and fauna. Beyond its primary function of sustaining life, water also greatly affects the *quality* of human life. Various historians have emphasised the role of water as one of the chief driving forces behind societal and cultural development (e.g., Böhme, 1988; Garbrecht, 1985; Schua & Schua, 1981). It is used for agricultural and industrial purposes, and serves as an important means of transport. Additionally, water has a high recreational value in many societies, and people across different cultures feel drawn to water bodies and, consequently, to water-related outdoor experiences and activities (Fontanari, 2004).

Education is a central tool in the protection of the world's water resources and the promotion of sustainable water usage. On a global scale, many efforts are currently being undertaken by a multitude of governmental and non-governmental organisations, operating on international and national scales, as well as locally. The latest campaign launched by the United Nations, for instance, is the current International Decade for Action 'Water for Life', which commenced in

2005 (United Nations, www.un.org/waterforlifedecade, latest date of access 28 March 2007). The level of priority associated with different water issues depends on the local conditions and needs. In some regions the supply of clean drinking water is the foremost concern (Helming, 2000), whereas elsewhere the focus is on facilitating access to water bodies and raising environmental awareness.

In Germany the focus of informal (i.e., non-school) water education has shifted in recent decades. In the past, pollution was one of the main concerns. However, over the last decades the surface water quality has improved greatly due to both technological advancements and educational campaigns, following national proclamations and the implementation of regulations, for example, based on the European Water Charter of 1968 (Schua & Schua, 1981). As a result, it has even been possible to organise swimming events along some of the major German rivers in recent years (http://www.rivernet.org/bigjump, latest date of access: 28 March 2007). This would have been unthinkable only two decades ago.

Over time, the tasks and contents of water education have changed. Nowadays, one of the main problems is seeking to overcome societies' estrangement from nature and natural resources. Water issues are currently not perceived as a foremost environmental concern by German society at large (e.g., Ipsen, 2003). It is hypothesised that the channelling of waterways underground, the inaccessibility of many of the remaining surface water bodies, the invisible disposal of wastewater, but also the constant supply of freshwater, contribute to the fact that water is barely an issue in every day life (e.g., Ipsen, 2003; Kluge, 2000). In short, modern German society lacks a conscious appreciation of water. However, only if people value nature, and more specifically water, will they truly be willing to protect it (e.g., Miller, 2005). German water education has increasingly picked up on this development in recent times and attempts to address this problem by using educational methods that go beyond imparting knowledge (Rettig, 2006).

The central questions now are: How successful are these contemporary water education approaches? And, what criteria must be met to ensure or at least encourage success? Within this context 'successful' means that the individual's environmental awareness is raised, ideally leading to an improved human–water relationship, which again promotes water protection and sustainable water resource management. To answer these questions, the research aims were to provide an overview of existing educational concepts, to develop and apply assessment criteria, and to evaluate actual water education activities. In order to do so, different theoretical and socio-empirical methods were employed.

RESEARCH APPROACH AND METHODS

A mixed-method approach was adopted, combining both qualitative and quantitative methods. The overview, the development of the assessment criteria, and the analysis of water education concepts were based purely on qualitative methods. The evaluation of different water education activities was conducted within the framework of a quasi-experiment, adopting a quantitative approach. The different methods used for data collection and analysis are briefly presented in the table below.

Table 1: Overview of the various research methods applied

Data collection	
Method	*Brief description*
Literature review *(qualitative)*	An extensive literature review was conducted to - obtain an overview of recent theoretical and empirical research carried out in the broad field of environmental education (main key words: environmental awareness, ~ behaviour, ~ education, water education, water and sustainability), - develop the research design (main key words: empirical methods, evaluation research, mixed-method research, qualitative research, quasi-experimental designs), - define the theoretical framework of the study (main key words: cognition, cognitive psychology, environmental psychology, psychology of perception), - develop the assessment criteria for the evaluation of existing water education concepts (main key words: assessment/evaluation of environmental education, effects of environmental education, measuring environmental awareness and behaviour).
Expert interviews *(qualitative)*	The expert interviews had two purposes: - to explore the field of German water education and obtain an overview of water education concepts and activities, - to obtain data as an additional source of information for developing the assessment criteria. In the case of the latter, the comparability of the information made available by the different experts played an important role. Accordingly, some guiding questions were formulated and incorporated into every interview, even though the interviews as a whole were not standardised and the question order varied. Altogether 14 experts, mostly practitioners offering water education, were interviewed.
Questionnaires *(quantitative)*	In order to analyse and evaluate the effects of different water education activities questionnaires were distributed among the participants prior to taking part and again four weeks later. The questions mainly targeted the collection of the following data: - socio-biographic details (age, gender, hobbies and interests, family activities), - knowledge and opinions before and after participating in the educational programme, - the individual's judgement of the different aspects of the educational programme. Target groups were: primary school children between the ages of 7 and 10 and teenagers between the ages of 11 and 14. The questionnaires were adapted to the age groups and the different programme contents.
Data analysis	

Qualitative content analysis *(qualitative)*	For the qualitative content analysis of the expert interviews the MAXQDA 2 software was employed. The main working steps were: - to transcribe the interviews, - to categorise the texts according to factual codes, which were largely defined on the basis of the guiding questions, - to classify the texts according to evaluatory codes conforming with the developed assessment criteria, - to generate lists of statements for comparative analyses. The analysis of the expert interviews provided data for the overview of existing water education concepts and activities, and facilitated the application of the developed assessment criteria.
Statistics *(quantitative)*	Descriptive statistics were employed to analyse the questionnaires. The analyses were based on comparisons of each individual's answers given both before and after participation. Additionally, correlations between different variables were analysed. As the number of questionnaires for the evaluation of the different water education programmes was rather small, the application of inferential statistics was inappropriate.

The data collected were analysed in accordance with the defined theoretical framework, which was based on the findings and theories of contemporary cognitive psychology. This framework takes into consideration the role of cognition, emotions, the natural environment, as well as the social and cultural environment.

RESULTS

The results presented are preliminary as some of the data analyses are still in progress, specifically those related to the application of the assessment criteria and the evaluation of the different water education activities' effectiveness. Nonetheless, some general tendencies can already be observed.

Overview of informal water education approaches applied in Germany

The common aim of contemporary water education is to familiarise participants with water issues and raise their environmental awareness, attempting to enliven the human–water relationship. Based on the data collected during the initial research phase of the study presented, four major approaches to water education were distinguished:

- museums and exhibitions mainly providing information,
- volunteer groups 'adopting' and caring for a local water body under the supervision of the responsible authority,
- guided tours or water education vehicles available for bookings by a wide range of target groups, and
- water education centres with their own indoor and outdoor facilities.

Despite the great variety of educational methods applied, all of the approaches promoted nature experience, were action-oriented and addressed all of the senses, although clearly to different degrees.

Another common feature was that many of the informal water education providers were only known locally and rather isolated from one another. At the same time, a few networks already existed at the time of data collection and most providers claimed to be open to co-operation, or at least information exchange.

The effectiveness of educational concepts

In order to evaluate the effectiveness of specific water education concepts, they were each analysed theoretically by applying the developed assessment criteria, and empirically by means of the quasi-experiment.

- *First findings of the theoretical analyses*

The assessment criteria were subdivided into five different categories: cognitive, emotional, and spiritual elements, social factors, and general external conditions. The criteria used for evaluating the cognitive features were derived from two nationwide studies evaluating environmental education in German schools (Eulefeld et al., 1993). The criteria for the remaining four categories were based on the literature review and the expert interviews. The individual criteria were not fixed, and remain subject to change as research is still in progress. Hence, criteria may yet be added, modified or deleted. Furthermore, the criteria applied may vary, for instance, with the target group, the proposed aims of the educational programme, or the general external conditions.
Overall, the first results showed that most of the 11 concepts analysed largely met the criteria representing the cognitive and emotional features, as well as the general external conditions (e.g., suitable locations for practical exercises). Some of the concepts explicitly incorporated social factors, which means that they paid special attention to group-related experiences promoting communication, teamwork, and trust. In the majority of cases spiritual elements, like the integration of water-related myths and mythology, played only a minor role in the educational programmes, if at all. Where they did form part of the educational concept they were considered to be an important component, however.

- *Preliminary results of the quasi-experimental study*

Three of the 11 water education providers analysed took part in the quasi-experiment. One of them offered a three-day programme for sixth and eighth graders (ages 11 - 14) and the other two half-day or day programmes for primary school children (ages 7 - 10).

The main tendencies observed so far are that younger pupils tend to be more affected by the educational programme than older ones. A clear change in the primary school children's ideas for possible water uses was evident. Before participating in the water education programme their ideas mostly revolved around uses within in the household, including drinking, cooking, and hygiene. Four weeks later their answers reflected the new experiences made during the programme, listing activities such as discovering aquatic species or playing in and along waterways. By contrast, the answers provided by the older pupils largely remained the same, mostly referring to hygiene, household and industrial uses.

Questions testing the participants' knowledge before and after participation showed similar tendencies. Only the question regarding the recognition of natural waterways (see figure 1) was partly an exception to this. Due to their higher level of knowledge and experience, eighth graders gave more correct answers to begin with. Nonetheless, the water education programme clearly had a positive effect, as appreciably fewer mistakes were made after participation. The improvement was less notable amongst the sixth graders who had taken part in the same water education programme.

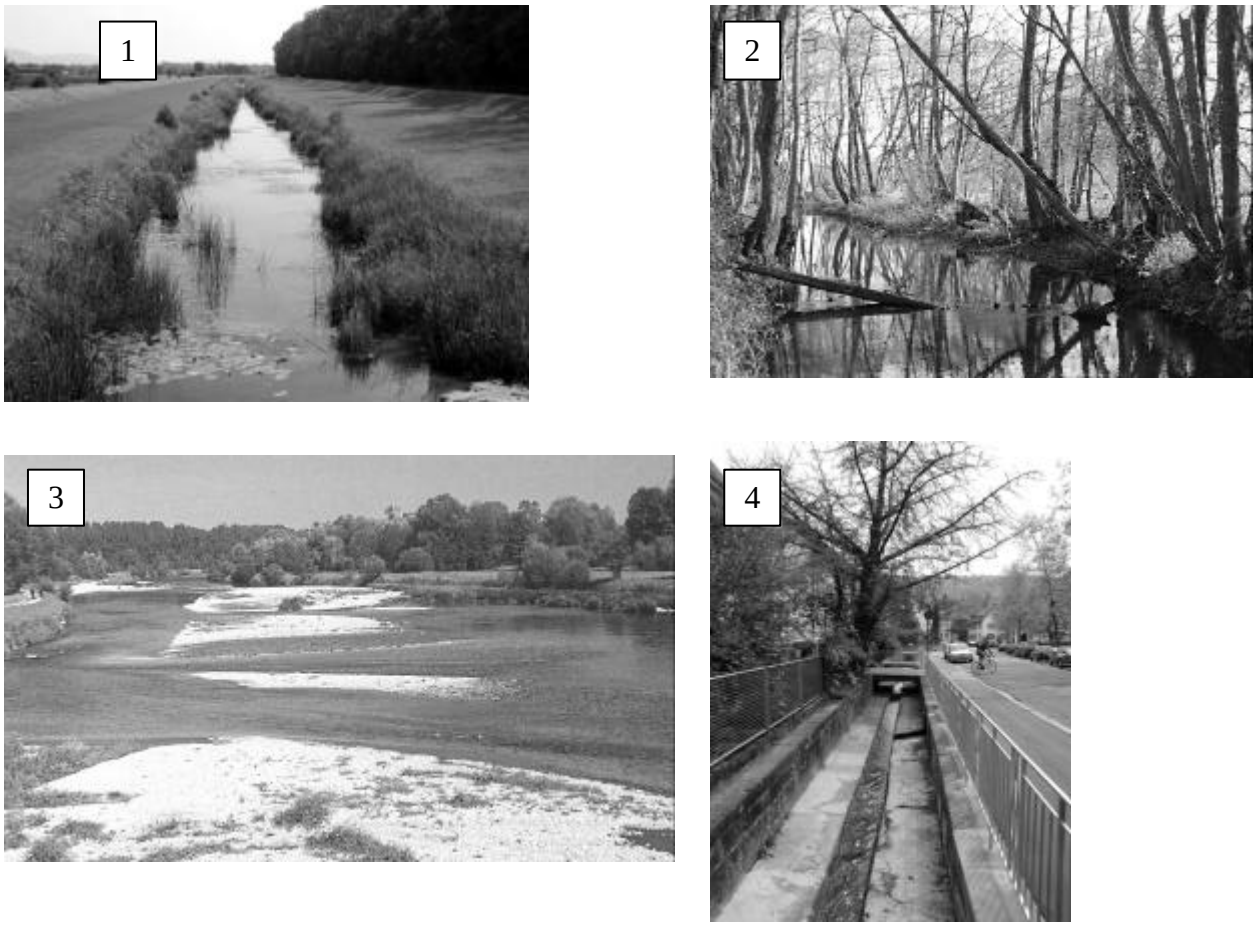

Figure 1: Pictures of the waterways used in the questionnaires. Pupils were asked to mark those they considered to be natural.

The same question was not part of most of the questionnaires addressing primary school children, because the contents of their programmes were different. The one group of fourth graders who participated in a programme also dealing with the topic of naturalness, showed a great increase in the number of correct answers in response to pictures 3 (natural) and 4 (artificial) as depicted in figure 1. However, there was hardly any difference in the answers provided with respect to the remaining two pictures. Both before and after, most children marked picture 1 (artificial) as a natural waterway, and picture 2 (natural) as an artificial one.

The older pupils were also asked whether their attitude towards surface waters had changed as a result of the three-day programme. The majority answered that it had not. However, some stated that they had already been aware of many water issues beforehand. Moreover, most of the teenagers expressed their concern about the state of surface waters, wishing for clean water, as well as natural waterways, for instance.

GENERAL CONCLUSIONS

With regard to the concepts' effectiveness, general tendencies were already evident and many of the concepts appeared to fulfil the requirements of modern cognitive psychology, indicating

that they should affect their target groups successfully. In the final research phase it must be determined which criteria are mandatory, and which are optional. Furthermore, it must yet be ascertained how transferable the final assessment criteria are. Might they be applied cross-culturally, or are they only valid within a Central European or even German context?

The first results of the quasi-experiment are ambiguous and only partially confirm that the implementation of the examined concepts has a noticeable positive effect on the target group. All in all, it could so far be observed that the older the school children were, the weaker the effect. Further analyses of the collected data may provide clues to explain these trends. At the same time, the assessment methods applied within the scope of this study must also be further analysed and discussed.

Nonetheless, there will undoubtedly be need for further research in order to examine what special requirements different target groups have, and what other factors influence the rate of success. Only when it is known what elements must be included in water education concepts in order to have a positive effect on the individual's environmental awareness, can the human–water relationship be improved successfully, promoting sustainable water resource management.

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