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### **From researchers to primary school: dissemination of scientific research results on the beach. An experience of environmental**

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# Dissemination of results in marine research

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**From researchers  
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## Abstract

Within the framework of the MEDCORE project on the ecology and management of Mediterranean coastal areas we decided to include the local dissemination of scientific results in Tunisia. The involvement of a local public school, and the joint work of local teachers and of local and international researchers, was chosen as

The complete text of the paper is available at <http://www.iopan.gda.pl/oceanologia/>

a dissemination method because of the role of the school as an educational centre and the natural interest and curiosity characterising the schoolchildren. As the subject of the experience of dissemination a beach-dune system was considered suitable because of it was near, familiar and easy to reach, and also because of the economic importance of such environments, which generate considerable income as a result of tourists frequenting them. In environmental education, however, less emphasis is placed on this particular environment. A test performed before and after a school trip to the beach showed an increase in knowledge among children about beach-dune systems. Correlations between the gender and background of the children with their previous knowledge and information acquired from the field experience were analysed, and found to be not significant. All the children were equally receptive to environmental issues, regardless of their gender or background (urban/rural environment). One of the main results obtained through this experience is the effectiveness of sharing knowledge with local people, as stakeholders of study sites. The next step in the process of disseminating scientific knowledge for the benefit of the local community should be to examine its possible long-term effects.

## 1. Introduction

A problematic issue in many research projects is how to make results available to the people beyond the scientific publications, and especially to the local communities living in the study areas. Such dissemination of information aims to integrate traditional knowledge with updated scientific knowledge, and through such integration to encourage stakeholders to take responsibility for the common environmental good. Local people are particularly affected by this lack of scientific information feedback, since they are usually the last to receive such information; at the same time, however, they are the real users of the environment. They are strongly linked to the environmental good and their quality of life is strictly related to the use of this good. Such knowledge could thus represent a tool for correct and sustainable management. Awareness of environmental conditions and of the consequences of management choices is the starting point towards responsibility and, as a wider goal, to local empowerment (Hart 1994).

This dissemination activity targeted school children, for a number of reasons. By definition, the school is a place of learning; moreover, primary school children have already overcome the egoistic phase of relations with the environment and are willing to investigate the environmental system in its entirety, including the relationships within its components and the role of human beings (Kidd & Kidd 1996). Children absorb knowledge both from the family and local community environment (with its own, unique cultural heritage), and from the school environment (with general education patterns). So they are in a unique position to be able to integrate both

information sources, thereby gaining a complete vision of the environment, with general rules and local characterisation. Children's knowledge of the environment is likely to be different among different socio-cultural backgrounds, being based mainly on abstract learning from distant sources of information rather than hands-on experience in the case of contemporary western societies, but on direct, experience-based learning, in the case of near rural societies (Cohen & Horm-Wingerd 1993). Today's children will be tomorrow's policy makers, so improving their knowledge and awareness will be an action with long-term effects.

The choice of a sandy beach as the subject of information dissemination was determined by a number of intrinsic characteristics of this environment. The sandy beach chosen for this activity was not only a local place, familiar to the Tunisian children, but it also had general characteristics that made it an educationally suitable place. Hart (1982) noted that children favour 'unplanned' landscapes with the following characteristics:

- Water
- Sand or dirt
- Trees, bushes, and tall grass
- Variable topography
- Animal life

As a sandy beach supplies all these features, it is affectively easy for children to relate to.

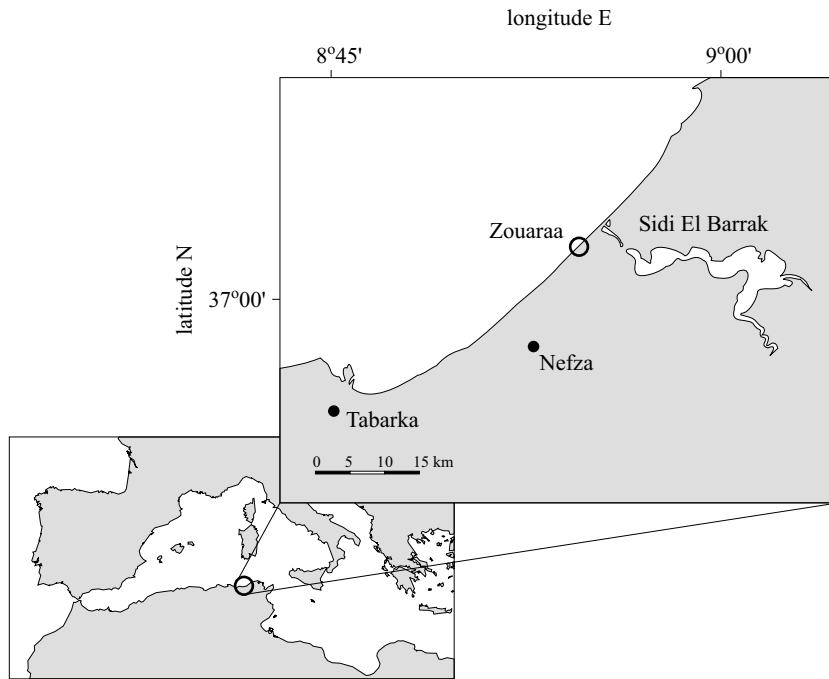
Apart from their affective aspects, sandy beaches play a unique ecological role, often less valued or neglected, in connecting land and sea. The understanding of a sandy beach as a living environment, with components and inhabitants linked by food chains and energy flows, is not instinctive. We therefore focused our field experience on the following issues: the structure of a beach; the beach as a living ecosystem (including the description of some plants and animals); stakeholder behaviour permitting the quality of a beach to be maintained through time. In addition, we laid stress on the fact that the sandy beach exists all the year round, and not just during the summertime.

In the wider perspective, a sandy beach represents a common good, shared by multiple stakeholders. Often, a consistent income can be generated from the use of a sandy beach, e.g., from recreational use, so that the maintenance of a high quality environment leads to greater environmental stability, not to mention benefits for the stakeholders' quality of life.

In regard to the effects of increased knowledge on stakeholder behaviour, it was noted that relationships exist between the care in maintaining a good

level sandy beach quality and the level of education of the beach users (Rodriguez Santos et al. 2005). At the same time, through a positive feedback, better beach quality fosters better care by the stakeholders (Pereira et al. 2003).

### Zouaraa beach



**Fig. 1.** Map of the site. The circle indicates the Zouaraa beach (N 37°02' E 8°55')

The Zouaraa site has been a subject of study for many years. Within the framework of the MECO project (1999–2001, IC18-CT98-0270, UE contract), the components of the beach-dune system were analysed at the same time under different disciplines, and within the MEDCORE project (2002–2005, ICA3-CT2002-10003, UE contract) the knowledge of these components was integrated in order to achieve a holistic perspective and to supply tools for the sustainable management of resources. Both MECO and MEDCORE worked on case studies, Zouaraa being one of them. The beach-dune system was analysed following an integrated approach by different, complementary international teams (Institut Scientifique, Rabat, Morocco; CNR, CONISMA, Italy; CURS, UK; APAL, Tunisia; FST, Tunisia; IEI, Malta). The results have shown up the strengths and weaknesses, as well as the characteristic features, of such a system.

The construction of a dam (Sidi El Barrak) meant reduced deposition of sediments on the one hand, but freshwater on the other, with new habitats for species, particularly birds (*Anatidae*), associated with fresh water. The mouth of the River Zouaraa and the mobile dunes represent a source of habitat diversity, with a consequent species richness characterising the system. The mobile dunes of Zouaraa are in dynamic equilibrium, and have to be preserved from erosion, due to the effects of the dam and to the harvesting of *Ammophila arenaria*. This plant is locally used for handicrafts, but if its cutting is regulated, both a traditional art and the stability of the dune system can be maintained at the same time. The tourist season is short (July–August), and the beach is accessible only by car. (Charfi-Cheikrouha et al. 2000, El Gtari et al. 2000, Bouslama et al. 2001, Scapini et al. 2002, Colombini et al. 2002, Scapini (ed.) 2002, Caffyn et al. 2003, Oueslati 2004).

## 2. Material and methods

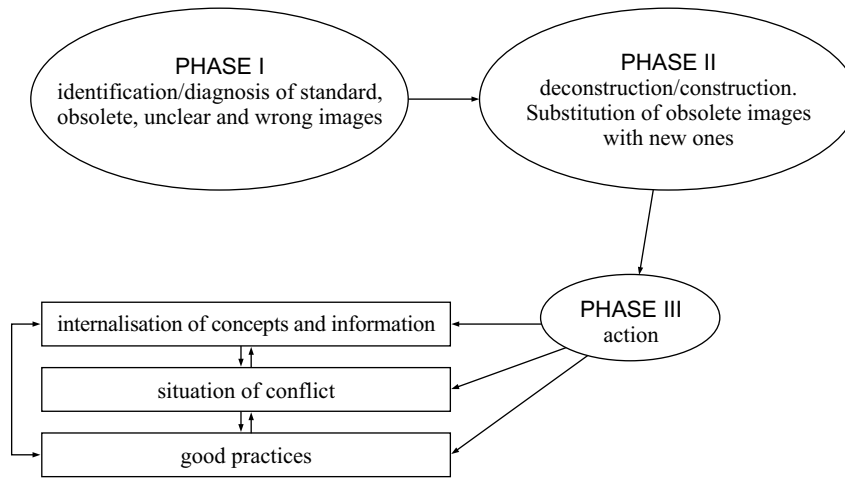
The field trip to the Zouaraa beach was organised in June 2005, involving children of the ‘El Joumhouria’ public school in Nefza (c. 15 km from Zouaraa). The children were from grades IV, V and VI, i.e., the expected age range was 8–11 years; it was assumed that they already had experienced environmental education at the school.

A test addressing 10 questions related to the issues mentioned above (physical description of the beach components, living organisms characteristic of a beach, human use of and behaviour on the beach) was handed out to each child just before the field trip. At the same time the children received a questionnaire intended to characterise them socio-culturally. The content of both the test questions and the questionnaires for socio-cultural characterisation was decided at a joint meeting of researchers and teachers.

On the beach, the children were grouped into teams which they picked themselves (5–6 children/team). At the small group level, each team discussed the same questions in the test one by one and produced a response. At the end of the discussion relating to each question, a game was played to order the teams. In the resulting order, the teams explained and discussed their answers at the whole group level. Finally, the researchers explained the correctness/incorrectness of the children’s responses, answered related questions and solved possible doubts. Further examples supplied by the children were also discussed.

Fig. 2 shows the conceptual scheme followed during the activity (Elamé 2002).

The same ten-question test was repeated the day after the field trip. Though anonymous, the tests were identified by a number, so that it was



**Fig. 2.** Theoretical scheme of the activity carried out on the Zouaraa beach

possible to compare the variation between scores obtained before and after for each child.

The teachers at the school evaluated the tests; the range of scores was from 1 to 20.

### 3. Data analysis

The null hypothesis of the same mean score obtained in the tests before and after the field experience was tested with the *t*-test. Data normality was checked with the Shapiro-Wilk test and in the case of non-normal distributions, data were log transformed in order to apply the tests.

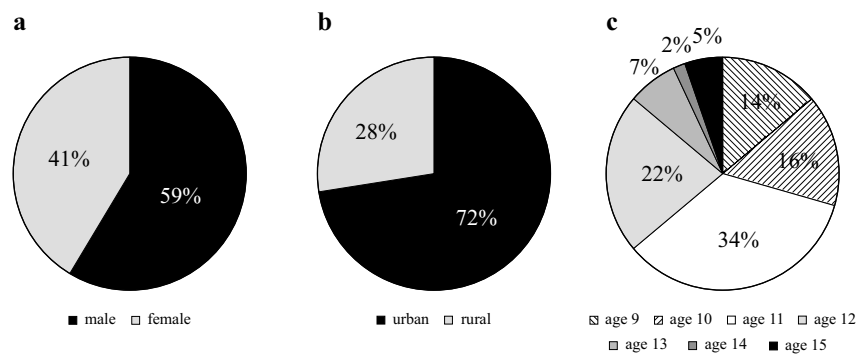
ANOVA was used to identify differences in test scores with respect to gender and background. Homogeneity of variances had previously been checked with the Bartlett test. ANOVA was performed on the results of the first test in order to evaluate the starting level of knowledge on the issue under study, whereas in order to evaluate the effectiveness of the experience, ANOVA was applied to the delta score between the results of the two tests. Other information from the socio-cultural characterisation were considered, but not included in the ANOVA: age, school level and sources of environmental information (six questions on different information sources, thereafter grouped as 'local' and 'general'). The ages of the children were non-uniformly distributed within the school levels, so that analysis of such factors was avoided. All the children had had experience of both 'local' and 'external' information sources, and they had received environmental education at school, so that they were considered experienced with respect

to the available environmental information sources (local, general and scholastic).

#### 4. Results

Although a total of 64 children participated in the activity, only 58 tests were worked up statistically; in 6 tests the codes of identification within tests or questionnaires were missing or incorrect.

Fig. 3 shows the characterisation of the children involved in the activity, and Table 1 the environmental information sources that they had experienced. We assumed that all the children had received environmental



**Fig. 3.** Children's profiles ( $N = 58$ ) by gender (a), background (b), age (c)

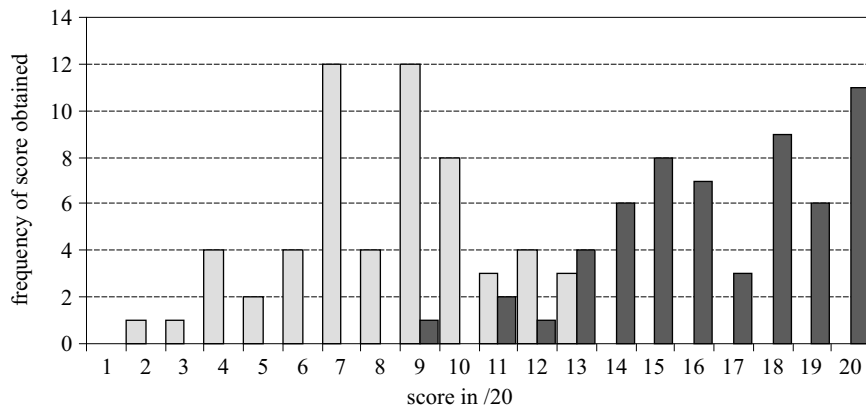
**Table 1.** Children's environmental information sources beyond the school curriculum

Question	Information source	Yes				No
Can you swim?	local	83%				17%
Do you read books about nature?	general	100%				
Do you watch documentaries on TV?	general	99%				1%
Do you belong to a cultural club?	local	36%				64%
Do you talk with your family about the environment?	local	95%				5%
Do you go to the beach?	local	always 47%	often 34%	sometimes 17%	never 2%	

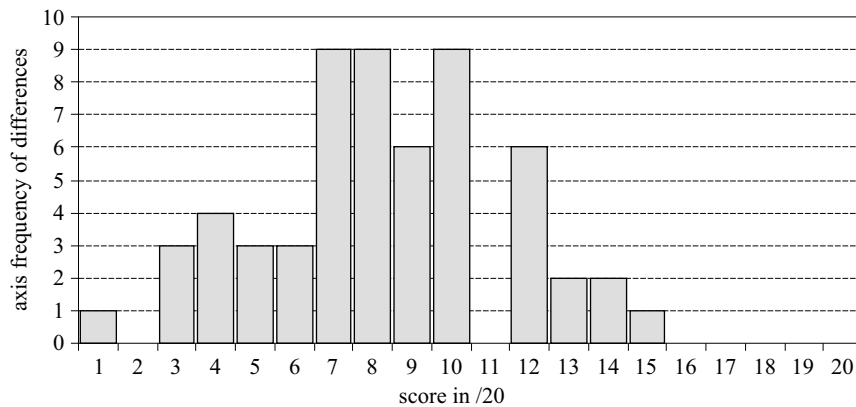


information of both a local and a general nature, since all of them had experienced at least one of the sources.

Fig. 4 shows the scores of the test held before and the test after the field trip; the delta value between the scores of the two tests is given in Fig. 5. If we look at the evaluations obtained at the whole test level (total score 1–20), the scores of the second test were distinctly higher than those of the first one. Differences in gender and background, as well as their interaction, were not significant, with respect either to the first test or to the difference between tests.



**Fig. 4.** Comparison of tests, before and after the field excursion. On the X axis: score in /20; on the Y axis: frequency of score obtained p values of paired *t*-test  $< 0.001$  ( $df = 57$ )



**Fig. 5.** Difference in score obtained between tests. On the X axis score in /20; on the Y axis frequency of differences ( $N = 58$ )

**Table 2.** Responses to single questions; comparison among tests before and after the activities. Values are expressed as percentages

Question	Test before the activity		Test after the activity		Difference in correct response
	correct response	any response	correct response	any response	
1. How can you describe the beach?	39	12	96	2	57
2. Where does the sand come from?	16	14	70	3	54
3. How does it create the dune system?	49	3	95	0	46
4. Is there life in a sandy beach?**	67	12	100	0	33
5. Are there living beings spending their life exclusively on the beach?**	67	16	97	0	30
6. Can living beings contribute to conservation of the sandy beach environment?	72	12	95	2	23
7. Are there features not related to a sandy beach, but which you can find on it?*	21	31	66	7	45
8. Which are the things that could damage the sandy beach environment?	51	2	74	10	23
9. What can we do to preserve a sandy beach?	84	0	89	0	5
10. What is the correct behaviour on a trip to a sandy beach?*	23	4	63	0	40

\*Three examples were required: the response was classified as correct when three correct examples were supplied; \*\*the choice was between 'yes', 'no' and 'I don't know'. There was space to add further examples. The examples supplied were used to evaluate the final test score.

Analysing the single questions put in Table 2, we see that although the amount of increase in correct responses differed from question to question, the correctness of the responses did always increase and uncertainty did decrease, except for question number 8. With regard to the groups of questions about the structure of a beach (1–3), the beach as a living ecosystem (4–6) and the sustainable use of a beach (7–10), the increase in correct responses was distributed non-uniformly, being higher in the first group of questions than in the other two. The smaller increase in correct responses to question number 9 was probably due to the already high percentage of correct responses obtained in the first test.

## 5. Discussion

First of all we would like to stress that doing the activity directly on a good quality beach like the one at Zouaraa provided a ready supply of practical examples (animals and plants) when needed. The involvement and the active participation of the teachers in the organisation of the experience and in planning the questionnaires was fruitful in many respects, e.g., the suggestion of aspects to be analysed among their students, and the enhanced role of the teachers in network building between the different levels of instruction (Morin 2005).

This kind of information flow (the latest results from scientific research projects to local stakeholders) could reduce the gap, often related to distrust, between scientists and local people. In turn, information sources represented by stakeholders' knowledge of their own environment reinforces and is fruitful for research at study sites.

Analysis of the results showed a relevant increase in information about the sandy beach environment following the field experience. As far as the thematic groups of questions are concerned, the greater variation in the percentage of correct responses related to the definition of the beach-dune system and the description of its structure (questions 1–3). These were simple pieces of information to learn, but had probably often been neglected in general-level environmental education. The increase in correct responses, albeit with a high variation score, was smaller in the group of questions on beach wildlife (4–6), probably because the scores relating to these questions were already high in the first test. Within the last group of questions (7–10), the high percentage of correct responses and the consequent small increase after the test obtained with respect to the question 'How to preserve a sandy beach?' was probably due to the messages coming from many sources of general environmental education, such as TV and environmental education campaigns, as well as from schoolteachers. The increasing uncertainty surrounding the definition of correct behaviour of stakeholders on the beach

was probably related to the re-definition of the beach environment itself, obtained through the experience at the Zouaraa beach.

The schoolchildren were receptive to environmental issues, regardless of their gender and background. They spontaneously searched for many other information sources outside of school, experiencing direct contact with their own environment. This is no longer a foreseeable behaviour, especially in view of the trends of contemporary societies which, wherever possible, avoid experience in an uncontrolled context, including direct field experience, and strive towards an exclusively theoretical and non-localised kind of knowledge.

An important issue emerging from this study is the importance of education focused at the local level, evaluating local traditional knowledge and familiar environments. The local environment of the beach includes the human presence and many different human-linked environmental features. In contrast, general sources of environmental information often promote exotic and/or pristine environments as the only interesting ones, and neglect the value of the local one (P. Candela Quesada 2006, communication). Engendering interest in the local environment could be a stepping-stone to local empowerment and responsible use of the common good.

Besides the success in information flow obtained through this experience, as would be expected in an activity involving both the cognitive and affective domains (Iozzi 1989), the study brought some interesting points to light: the lack of attention of general environmental education given to the near, familiar environment, and the need to reduce the gap between researchers and local people, who have a continuous and direct experience of those environments considered as case-studies by the researchers. Addressing the latter aspect could lead to the avoidance on the one hand of 'knowledge without faces and without place' (Sachs (ed.) 1993) on the part of the researchers, and on the other, of the feeling of distrust towards the research on the part of the stakeholders (Charpak 2001). Within the MECO and MEDCORE projects, besides the collection and analysis of environmental data, the need emerged to involve local students and educators in projects as well, with the aim of sharing all the available knowledge, and of strengthening links between the environment, the local inhabitants and the researchers.

Finally, the long-term effects of environmental education are likely to depend on the socio-cultural environment and dynamics, and on individual ways of expressing meaning. Although these effects are extremely difficult to monitor, an increase in knowledge could represent a good tool in order to develop awareness about the common good and the choices for its management.

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