

A European project for science education: what did we learn?

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SMEC began with the vision to study the educational relationship between museums and schools as a way to enhance science education and to develop young people's familiarisation with sciences. Science museums and science centres play a prime role in public understanding of science by creating the conditions and developing methodologies in order to enable people to have first-hand experience of scientific phenomena and to develop curiosity, awe, motivation, interest to know more, understanding and learning. Science museums are also actively involved in school education providing a range of activities for pupils, offering resources and specialist support to teachers and organising training initiatives for school staff. Such work is recognised as being of special importance in the context of the European Union policy for science education. The strategy undertaken by the European Council in Lisbon in 2000 explicitly sets the objective to increase young people's interest in science and science museums are recognised as among the out-of-school resources for introducing new methods for educating in science and for linking science and real life (European Commission 2003, 3).

But how common are the educational methodologies used by different museums for working with teachers and pupils? How widely shared are the methods for engaging with science, or the approaches to learning in different countries? Can we talk about common principles for using museums for science education?

These are among the questions raised by *SMEC*, the answer to which has been sought through experimental work with schools and exchange of experience among partners. Seeking the answer to these questions does not aim, though, at the creation of a single approach abolishing differences between distinct methodologies characterising the work of each (partner) institution. It aims, rather, to the identification of a common ground, of quality elements, which have been experimented through shared activities and can, eventually, be used as a model for further work, outside the SMEC partnership as well.

The project offered the opportunity for studying science education not only from a content point of view (which activities, which resources, which methods for teaching and learning in science) but also as experience. The museum is a unique milieu and resource "allowing people to experience a new phenomenon in an interesting way" (Doherty 2004). Opportunities for engaging with science means experiments, work with exhibits and objects, use of specialised knowledge; but, at the same time, it means involvement of skills, behaviours, emotions, personal encounters, multi-disciplinary knowledge, making thus the experience richer as well as more complex.

The complexity of the museum experience lies not only on the distinct nature of the museum but also on the teaching and learning approach adopted in the various activities and resources. Different from the approach adopted at school, museum teaching and learning are characterised by the following aspects, as those have been identified and shared by the partners in the project:

- a. the museum object or exhibit acts as starting point, as focus, as tool;
- b. the original object acts as document (container of knowledge, information, context);
- c. the museum experience can be the key component of a three-part unit (preparatory work – museum visit – follow-up work);
- d. the museum is seen as 'special learning space' (discovery learning; learning outside school);
- e. personal experience/knowledge of the pupil is a fundamental basis for building knowledge;
- f. learning usually starts with a question/problem and involves problem-solving processes;
- g. active-collaborative learning takes place;
- h. museum learning is multi-disciplinary.

In other words, the educational methodology adopted by the science museum in its work with schools (and with the public in general) is built on the understanding of its role as 'facilitator' rather than as 'teacher' in the traditional sense. Experiences are built on concepts that can be explored through observation or active experimentation. Deepening into a concept not easily explicable can, of course, take place, if deriving from a question that appears to be shared by the majority of individuals present, but starting from the concrete, observable reality is the key to exploration and understanding (Miotto 2002, 45).

Work among the partners, in collaboration with schools in each country, challenged the role of the museum itself when working with teachers and pupils. How much can the museum 'accommodate' teachers' requests? Is there a difference (and how big is it?) between the 'normal' educational provision of the museums and what has been done within *SMEC*? The results of such reflection led to increased awareness about the nature of the relationship between museums and schools and of the conditions under which such relationship is realised.

Working in partnership means identifying ways for making approaches complementing rather than contrasting. In order to arrive to effective results, it is necessary, therefore, to be familiar with the content, policy, needs, choices of both institutions. The teacher and the museum educator are the two key-figures in this partnership. Competence, strategies for working together, awareness of methodologies, confidence are issues of direct relevance for the success of the work. Therefore, training emerges as among the fundamental needs when talking about the use of museums in science education. In-service training is another of the objectives of *SMEC* met through the development and realisation of the European In-service Training course for teachers and museum educators.¹ The preparation of the course offered the opportunity to reflect on the approach to training, especially in this case in which a course is offered at European level, therefore with no particular reference to a specific (country, museum, school) context. Indeed, this helped studying more closely the role of the teacher and the museum educator within the partnership and, thus, the principles on which to build training of these professionals.

The results of work indicated that training should go beyond the presentation of a specific museum collection or activity, to focus on the development of skills and knowledge adaptable in the particular case of school or museum. This means that training should focus on the development of:

- acquaintance with the museum as *institution* with conservation, research, education functions as well as a place for direct experience of science;
- understanding of the distinct character of school and museum learning;
- methodologies for working with the museum as resource, that is, working with original objects, with exhibits, with the museum website, etc.;
- skills for active engagement (active learning, discovery learning);
- methodologies for project work in which the museum experience is incorporated rather than seen as a sporadic, no-consequence excursion of the pupils;
- action-research strategies as a tool for monitoring of action and for professional development.

In this approach, the museum educator has an important role, that of 'facilitator' of learning. He/she possesses the knowledge and competences necessary to create the necessary conditions leading to engaging people in science-oriented experiences, such as observing and exploring objects, working with exhibits, etc.; as well as the sensitivity to note potential difficulties, such as problems in pupils' understanding, and to take action in order to smooth the progress of the activity (Miotto 2002, 45; Xanthoudaki 2000). On the other hand, the teacher is asked not only to step into action (rather than remaining a mere observer of what happens), but to become a confident and knowledgeable user of the museum. Training aims at familiarising teachers with the museum as method and as source of knowledge and experience by addressing them first through personal experience, on which subsequently to build strategies for pupils' own work.

Identification of the training approach emerged not only from the partners' expertise in the field as well as joint work, but also from work with the schools. Teachers working with the *SMEC* team participated in small-scale pilot training activities in each country, set on the basis of the needs of their specific work for the project. These activities aimed, before anything else, to support teachers in the activities they were asked to carry out but offered us, at the same time, the opportunity to live closely different aspects of the museum-school relationship realised at the same time in different places. The nature of the visits to the museums, unexpected aspects of the experience, teachers' needs provided data on which to reflect when the time came for developing the modules of the European in-service training course.

On the basis of the work and research with schools, *SMEC* produced and presents this 'Manual of good practice'. The manual contains examples of work and guidelines for collaborative projects between schools and science museums. The two introductory chapters offer stimuli for reflection on more general issues regarding museum learning and visit organisation, which can be useful to teachers or museum

¹ The first edition of the course takes place at the Deutsches Museum in Munich from 8 to 13 November 2004, and the second one at the National Museum of Natural History from 7 to 12 November 2005. All costs for participation can be covered by Socrates grants of the European Union to teachers and museum educators from any EU member or associate country. For more information: xanthoudaki@museoscienza.it

educators. The other chapters introduce case studies of school work carried out in each country in collaboration with the partner museums. They are presented in such a way as to offer ideas and resources for the development of further projects in any context.

In this work, each partner worked in its specific (country and educational) context, putting into action the methodologies identified by the project and meeting the objectives set by the group. In this case, European dimension means joining distinct characteristics emerging from such kind of work into a common proposal, rather than designing a neutral idea with no visible culture-oriented elements. This is actually the stimulus for the language organisation within the manual. The paper version is in English in order to supply an easy-to-use basis for the exploitation of the material contained in the cd. The cd contains this introduction and the two general chapters in seven languages: English, French, Italian, German, Spanish, Hungarian and Flemish. It also includes the chapters of the school projects in a more detailed version with additional resources (worksheets, photographs, etc.). These chapters are available in English and in their original language.

This choice is an invitation to schools and museums interested in using this material to explore other languages than their own, addressing, thus, further skills and knowledge. In a European Union which is enlarged from 15 to 25 member countries, in which from 1 May 2004 a large number of languages is spoken, transnational cooperation means also getting to know the languages and the culture of our fellow-citizens in other countries as well as learning from their examples and experiences. Science museums do contain and address issues related to science and have a specific role in science education, but they also contain evidence of common cultural heritage and can – should – certainly address culture-related issues. SMEC did not have language teaching among its objectives, but this is an issue which exists in parallel to any experience and work within a European project and is, therefore, a dimension which should not be ignored.

Out of these considerations, the answer to the questions raised initially² can only be that educational methodologies used by different museums *are* shared. Contents and contexts are rich and diverse, but the mode in which a museum is used for science education is, as already said, more or less common: facilitator of understanding, provider of first-hand experiences, stimulus for further learning. In this, active engagement of visitors, learning by discovery, building on personal knowledge and experience are among the principles adopted in most cases.

SMEC has attempted to identify and reflect on these common elements of the museum-school relationship for education in science. We hope our work can be seen as a way to start an on-going debate capable of contributing to further research and action in the field.

We would like to thank all the teachers and the pupils in Belgium, France, Germany, Hungary, Italy and Spain, who worked with our team for the devising and realisation of this project. Without them, our experience and contribution would certainly be poorer. Special thanks goes also to the project group who worked with devotion and enthusiasm for the realisation of the activities as well as to the translators, editors and graphic designers who took care of the other aspects of this publication.

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² How common are the educational methodologies used by different museums for working with teachers and pupils? How widely shared are the methods for engaging with science, or the approaches to learning in different countries? Can we talk about common principles for using museums for science education?