Grant Agreement number: 226646 -CP- 1- 2005-1-IE-COMENIUS C21 (2005-3264)

PROJECT OBJECTIVES (ref. Application)

Rationale and background to the Project:

The direct concern of this project will be to make use of the wide range of heritage sites across Europe as a teaching resource, with a particular emphasis on the teaching and learning of Science. To achieve this we will design suitable innovative teaching methods, which utilise the advantages of handheld technologies in "non-traditional" classroom environments. The rationale for this project is based on a significant volume of current research in science education, and several of the Partners are leading researchers in this field.

Heritage is something that is passed down from preceding generations (Dictionary.com). Heritage sites include galleries, the natural environment, museums, and libraries, which serve to promote and mediate learning.

Formal, informal and self-directed learning can occur in Heritage sites. For example, museum exhibits allow visitors to engage in constructivist learning by drawing their own conclusions about the meaning of exhibits. There may be multiple paths through a museum and a range of modalities to acquire information, each of which may suit the different learning styles of different visitors. According to some researchers, heritage sites offer a common wealth of informal, enjoyable and contextualised environments, rather than the decontextualised, formal classroom.

In the sciences, the use of Heritage sites as vast, potential, academic resources particularly in the natural and environmental sciences, has been highlighted by various researchers including McManus (1987), Lucas et al (1997), Tunnicliffe et al (1997), Tunnicliffe (2000) and Solomon (2001).

Handheld technologies are those portable computational tools that are small enough to be held in one's hand (Webopedia Computer Dictionary). Examples of such technologies are the Personal Digital Assistants (PDAs), handheld-PC, mobile phones, intelligent active badges and wearable computers.

Handheld technologies are unobtrusive computing devices that accompany the user and provide assistance in a variety of situations and for a wide range of tasks (Schmidt & Beigl, 1998).

Computational technologies have become increasingly important to the practice of science – computers play a central role in data collection, data analysis, modelling, and the communication of results in scientific research (Edelson, 2001).

Given the numerous opportunities for informal learning that heritage sites provide and the mobility and wireless advantages of handheld technologies, best practice models can be built upon the use of both in science teaching. Such an approach provides an innovative way of teaching and learning science, which supports the development of contemporary understanding both *in* and *about* science.

Overall aim of the Project as well as its **specific objectives**.

The development of innovative teaching methods and tools which demonstrate best practise models for the use of heritage sites in Europe as an "Outdoor laboratory" for Science Teacher Education.

Specific Objectives:

- To Explore the Premise that the decreasing interest in Science is due partly to existing Teaching Methodologies.
- To Compare and Contrast Existing Science Teaching Curricula and Pedagogy in each country
- Provide exemplar methods for the use of handheld technologies in Heritage Sites as innovative tools in Science Teacher Education
- To create new teaching Modules which utilise these methods in Science Teacher Education
- To promote mobility initiatives between Science Teachers and Student Teachers in Partners countries

Innovative Aspects of the project.

The use of the “outdoor” non-traditional classroom combined with problem-based learning and the constructive use of handheld technologies in learning experiences is innovative. Traditional classrooms tend to be closed systems where information is filtered through layers to students. In general, the use of resources is limited to what is available in the classroom or within the school. Traditionally, the use of technology is focused on learning about the technology rather than its application to enhanced learning. Lesson plans are used to organize the various steps in the learning process for the whole-class approach. On-target questions that would tend to cause deviations from the plan are met with, "We will get to that later."

Innovative use of technology tools have re-shaped the way teaching and learning is viewed during the last decade as they provide access to information, the means to engage and manipulate resources and the opportunities for communication of ideas and collaborations at both individual and institutional level. In fact, computer software applications have been extensively used in a plethora of ways with students of different ages because of their potential to support learning.

Jonassen (1996) referred to computer software applications as mindtools, which have the potential to engage learners in a variety of critical, creative, and complex thinking, such as evaluating, analyzing, connecting, elaborating, synthesizing, imagining, designing, problem solving, and decision making. Sage and Torp (1997), proponents of project/problem based learning, have this to say about its benefits: "Educators report that students involved in problem-based learning find learning more stimulating, build critical and creative thinking skills, become more self-directed learners, and make more meaningful connections between school learning and learning for life."

Pedagogical approaches

The constructivist theory of learning is particularly relevant to the educational use of heritage sites. Constructivism proposes “that knowledge is

created in the mid of the learner from a combination of prior experience, novelty and personal learning methods".

Traditionally, schools stressed the accumulation of information, and did not emphasize skill development or nurturing inquiry-based habits of mind. Our modern society is faster paced, globally networked, technologically oriented, and requires workers who can problem solve and think critically. Today, much learning, if not most, occurs after formal schooling. Our schools must change their approach to education to produce students who can thrive in the modern world.

The inquiry learning approach is more focused on using and learning content as a means to develop information-processing and problem-solving skills. The system is more student centred, with the teacher as a facilitator of learning. There is more emphasis on "how we come to know" and less on "what we know." Students are more involved in the construction of knowledge through active involvement. The more interested and engaged students are by a subject or project, the easier it will be for them to construct in-depth knowledge of it. Learning becomes almost effortless when something fascinates students and reflects their interests and goals.

This approach provides the student with the opportunity not only to learn the about the effects of prevailing winds but, more importantly, to ponder and question the nature of indirect scientific evidence as well. Thus, an inquiry approach can help students connect science with the scientific method. Students learn to apply the method to various fields of study while coming to understand their content, and thus become an enriched learner.

Target groups and Expected impact:

Reform documents in contemporary science education criticize the way science has been portrayed and taught in schools (Millar & Osborne, 1998; National Research Council, 2000). Taught in the traditional manner, school science estranges students because it is disconnected from their everyday experiences; portraying science as a set of objective and absolute truths to be approached and apprehended as abstract, disembodied and decontextualised knowledge.

Grant Agreement number: 226646 -CP- 1- 2005-1-IE-COMENIUS C21 (2005-3264)

For the majority of our **youth** and future citizens, the outcome is a sense of exclusion – that science lies beyond the realm of their experience (Osborne & Collins, 2001) denying them any access to one of the major achievements of contemporary culture. Considering this problem, the impact of the proposed research, is associated with constructing innovative methods of providing access to scientific knowledge – ones that are current, technology-enhanced, appealing and personally meaningful.

It is expected that through the proposed work, **science teachers** will develop contemporary understanding of teaching science and develop the necessary technology skills that will then apply to their own teaching practices. The impact then, on the **young learners**, is one of providing motives to acquire knowledge *in* science and *about* science as well as developing understanding about the work of scientists.

With the use of handheld technologies it is expected that young learners will acquire the skills needed to use technology tools through engaging in scientific practices such as collecting and communicating data, which model the practices of field scientists.

The fact that the proposed work is taking place in heritage sites not only stimulates the interest of young learners for participation in scientific activities but it also enhances their learning as it situates their experiences in contexts that are personally relevant and meaningful.

Duration of the Socrates support:

Given the objectives, activities and the expected outcomes the project will require three years in order to be completed. The review, design and operational phases of the project require three years and cannot be completed in less.

Envisaged outputs

ECT and NZS will participate in the design of the In-Service Training Course in Year 2 and the course will apply to run under Comenius 2.2 in February Year 3 (2008). This course will demonstrate the methods and tools, which have been designed as part of the project for use in school by science teachers. The course

will accommodate **20 participants** and additional courses will be run if there is sufficient interest and funding is available.

The module will operate over **5 consecutive days**, 4 hours per day and include one field trip of 5 hours duration (25 hour course in total).

The main objectives of the In-service course are:

1. Introduce the methods and demonstrate best practice exemplars
2. Demonstrate and test the tools including the Web Forum and Teaching Kit
3. Undertake a field study using the project methods and tools

The Course will be advertised in the normal way and will take place in the Education Centre, Ireland. The Curriculum for the course will also be made available online at the project web site for online training purposes.

Mobility Program

Student teachers will be involved in Mobility Action .Four institutions – RESF, USP, UMU and UP-RO, will organise mobility actions as they are primarily involved in Initial Teacher Training, ECT, NZS, ITT AND UCY will receive students only.

Other results:

1. The Use of ICT for data collection, presentation and dissemination of teaching and learning materials
2. The development of ideas and themes for further research initiatives
3. The potential for publishing the results of the Project in various Research Journals, Seminars and Conferences

---