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Education and Museum: Cultural Heritage for Science Learning

GENERAL REPORT

ABOUT GOOD PRACTICES FOR ICTS AND INNOVATIVE METHODOLOGIES IN SCIENCE EDUCATION

in project countries: Italy, Greece, and Portugal

SAPIENZA UNIVERSITÀ DI ROMA

Istituto Comprensivo Via Val Maggia

museo galileo — Istituto e Museo di Storia della Scienza

ΠΑΝΕΠΙΣΤΗΜΙΟ ΠΑΤΡΩΝ — UNIVERSITY OF PATRAS

Directorate of Primary Education of Achaia
Department of Cultural Education

ΕΛΛΗΝΙΚΗ ΔΗΜΟΚΡΑΤΙΑ
ΥΠΟΥΡΓΕΙΟ ΠΑΙΔΕΙΑΣ, ΕΡΕΥΝΑΣ ΚΑΙ ΘΡΗΣΚΕΥΜΑΤΩΝ
ΠΕΡΙΦΕΡΕΙΑΚΗ Δ/ΝΣΗ Π/ΘΜΙΑΣ & Δ/ΘΜΙΑΣ ΕΚΠ/ΣΗΣ ΔΥΤΙΚΗΣ ΕΛΛΑΔΑΣ
ΔΙΕΥΘΥΝΣΗ Α/ΘΜΙΑΣ ΕΚΠ/ΣΗΣ ΑΧΑΪΑΣ
46° 10/Θ ΟΛΟΗΜ. ΔΗΜ. ΣΧΟΛΕΙΟ ΠΑΤΡΩΝ

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Agrupamento Escolas Coimbra Centro

NUCLIO — Núcleo Interactivo de Astronomia

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Executive Summary

This report presents the main findings from a research made by the Erasmus+ KA2 EDMUSE project consortium in order to investigate the current scenario in participating countries - Italy, Greece, Portugal - about the use of museum resources for science education. The research explored in particular the availability of digital resources from museums in science education for kids aged 8 to 12.
A number of similar aspects were found. We grouped them under 7 main points:

1. Different Education Systems
   In each of the countries investigated the target group belongs to two different cycles, but the turning-point year is different (4^{th}, 5^{th} or 6^{th}). This can have an impact on learning objectives and curriculum indications, because pupils of the same age in different countries can be considered more or less able and mature to understand a higher level of complexity.
2. (But) No Explicit Indications
   No specific indications or references are officially given about the use of cultural heritage and/or ICT for science education in partner countries.
3. (Just) Isolated Initiatives
   There are many interesting initiatives promoting the creation of cross-disciplinary didactic units in the target countries. They have two aspects in common: 1) initiatives range from robotics to exhibitions, i.e. are very diverse in the topic addressed and in the approach adopted; 2) they are all isolated, i.e. not integrated into the educational system.
4. (There are) Structural Issues
   Teacher training (teachers' digital competences in general) and resources availability are identified as major obstacles preventing or limiting the adoption of cultural heritage and/or ICT for science education in partner countries. Policy directions can also have an impact.
5. (And) Infrastructural Issues
   Here comes a very common paradox in many innovation processes: using ICT for science education without ICTs can be very complicated. You could solve this dilemma by adopting a BYOD approach, but a BYOD approach is not allowed in many schools. Again, it is a problem of investments and policy directions.
6. (And) Organizational Issues
   Time availability, within or without the curricular classroom timetable, is one of the strongest organizational issue when deciding to adopt ICTs for science education – and this is not included in the official programme/curriculum. This is linked to other mentioned issues, and to the overall policy framework as well.
7. But it is still worth
   Innovating in teaching is always a complex task because of many different factors interplaying. But it is still worth, as it can have a strong positive impact on learning outcomes and actually improve the quality of science education for kids. EDMUSE is a good occasion for doing it.

Edited by Vincenza Ferrara e Annamaria Cacchione

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Contents

Introduction

This report represents the Intellectual Output n. 1 of the EdMuse Project, funded under the Erasmus Plus Programme, Key Action 2: Strategic Partnerships, School Sector (agreement number: 2015-1-IT02-KA201-015013). This report contains the key findings taken from the national reports conducted by the partners, and cannot be considered an exhaustive study about the topic at issue. Rather, it represents a critical summary of all information and findings collected,

For a better understanding of the following sections, a lexical clarifications can be useful.
The term heritage hereby used, even if used without any other adjective, refers to several main categories of objects. We can adopt the following definition by UNESCO (http://www.unesco.org/new/en/culture/themes/illicit-trafficking-of-cultural-property/unesco-database-of-national-cultural-heritage-laws/frequently-asked-questions/definition-of-the-cultural-heritage/):

What is meant by "cultural heritage"?

The term cultural heritage encompasses several main categories of heritage:

- **Cultural heritage**
  - Tangible cultural heritage:
    - movable cultural heritage (paintings, sculptures, coins, manuscripts)
    - immovable cultural heritage (monuments, archaeological sites, and so on)
    - underwater cultural heritage (shipwrecks, underwater ruins and cities)
  - Intangible cultural heritage: oral traditions, performing arts, rituals
- **Natural heritage:** natural sites with cultural aspects such as cultural landscapes, physical, biological or geological formations
- **Heritage in the event of armed conflict**

For our purposes, the first and the second meanings (cultural and natural heritage) are relevant. This clarification is useful because the majority of the initiatives and projects aiming at innovating science education by exploiting museum heritage focuses on modern, often already digitalized resources. They offer educational resources that have been created just for educational purposes, not educational resources coming from objects (cultural heritage) created for not-educational (like archeological finds) purposes. EDMUSE, built on the previous experience of MUSED platform, brings cultural heritage to new life and provides young students with the amazing opportunity to experience museum heritage in an active, inquiry-based way. This implies a complete shift of perspective and approach, and mobilizes a complex set of competences and skills in teachers, researchers and curators.

In the following pages, we will summarize the data collected from the EDMUSE project partners about the good practices they know in the fields of ICTs and museum heritage for science education, in order to identify their main strength and weakness aspects and to select a set of key points to focus on for the development of the subsequent outputs.

The report is organized as follows:

- the first section describes the overall methodology for collecting and processing data (country reports and general report);
- the second section is articulated into seven paragraphs, each illustrating one key point emerged from the analysis of the country reports
- the third section offers some conclusions and recommendations
- at the end of the report, there are five comparative tables showing, in parallel, key content from the three country reports
- finally, there are the references about studies and data mentioned.

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Methodological Approach for conducting the Desktop Research

The methodological approach (O1-A1) in this analysis was based on a desktop research and a thorough exploration of papers, documents and websites with a twofold focus:

1: on the availability of digital resources from museums

2: on science education in the lower education cycles.

The state-of-the-art illustrated in the next section attempts to depict a portrait of the current scenario in participating countries about the use of museum resources for science education, keeping in mind that the target groups is composed of kids aged 8 to 12.

The general methodology approach applied was discussed with partners during the kick off meeting in Rome.

In order to facilitate the information collection, the partners were provided with the following outline developed by DigiLab Sapienza (project coordinator and coordinator of this action).

Each partner has to collect experiences and/or recommendations of its country about the following points - please, keep in mind that all the contents have to be addressed to students aged related 8 to 12:

1) Description of Education System of each country and correspondence school level s of 8 to 12 age (Eurydice) and related school curriculum (max 1 page)
2) National recommendations and guidelines for preparation and implementation of curricular materials (max 2 pages)
3) Experiences or recommendations about the use of cultural heritage, especially if issued from scientific museums, and about the use of ICTs by science teachers (max 1 page)
4) Experiences and materials for making cross-disciplinary didactic units (max 1 page)
5) Experiences of innovative practices in science teaching and in evaluating the impact for learning improvement
6) Possible issues and concerns
7) Do you know any concrete museum experience of museums using/share its heritage, also online, to help teacher to teach science? If yes, please describe and provide references.

All partners have performed the desktop research within the scope of their country. Data were thus collected for Italy, Greece and Portugal respectively by:

1. ITALY – DIGILAB Università La Sapienza di Roma, Val Maggia School, Galileo Museum: Vincenza Ferrara, Sonia Sapia, Fiorentino Sarro, Marco Berni
2. GREECE - Directorate of Primary Education, Department of Cultural Education, 46th Primary School: Andreanna Koufou, Maria Gotsopoulou
3. PORTUGAL – School Cluster Coimbra Centro, Coimbra University, NUCLIO: Manuela Carvalho, Piedade Vaz-Rebelo and Rosa Doran

The country reports were subsequently collected by the coordinator, who processed the data and wrote down this general, comparative report, that has been examined and validated by the consortium before being published on the project website.

Seven Points to Understand the Scenario

8. Different Education Systems

Being aware of the differences among member states regarding the organization of the educational systems (age levels and grouping of pupils), the first point at issue was the educational context of the target group (kids aged 8-12) in the partner countries.

The situation is slight different among the considered countries: in each of the countries investigated the target group belongs to two different cycles, but the turning-point year is different. The first cycle – referred as primary school or first cycle of basic education – can last 4 years like in Portugal, 5 years like in Italy, or 6 years like in Greece. On the other side, the first year of this cycle corresponds to the 6th year of age for each country.

The table below show the differences and the similarities:

Country	Cycles	Years of Schooling	Age
PORTUGAL	**1st cycle**	1st – 4th	6 – 10 years old
ITALY	**1st cycle**	1st – 5th	6 – 11 years old
GREECE	**1st cycle**	1st – 6th	6 – 12 years old
PORTUGAL	**2nd cycle**	5th – 6th	*2º Ciclo do Ensino Básico* 10 – 12 years old
ITALY	**2nd cycle**	6th-8th	*Scuola secondaria di primo grado* 11 – 13 years old
GREECE	**2nd cycle**	7th-9th	*Gymnasium* 12 – 15 years old

This difference in the ending year of the main cycle can have an impact on the learning objectives and the curriculum indications about the topics at issues, because pupils can be considered more or less able and mature to understand a higher level of complexity. Furthermore, knowing the curriculum indications could help in identifying the way the topics at issues are treated in the different context. That's why the second question was about the curriculum contents.

As it is shown by the Comparative Table n. 1 (see below, at the end of this report), the national systems can differ in approaching the learning content, varying from a more general approach, like Italy, focused on

general indications about the need to develop a scientific attitude in kids, to a more focused approach, identifying subjects and themes in detail. This difference does not reflect the difference in the articulation of the education cycles, as described before.

In all the three cases, the subjects covered include Physics, Chemistry, Biology, History, Citizenship and Earth Sciences/Geography.

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9. No Explicit Indications

This item was one of the most relevant of the whole survey. It has been asked to identify which official indications are provided by the national curriculums about the use of cultural heritage and/or ICT for science education. All the three partners converged in stating that no specific indications or references are given about these points. There are some indications in Italy about digital competences in this context, as well as there are several statements about the relevance of national heritage, but **no specific, concrete indications are provided about one or both these components in relationship with science education**.

The examples of key initiatives conducted in this field are of the same type: they, as the Portuguese PATRIMÓNIO project, address only one of the topics at issue – only cultural heritage in the case of the mentioned project. In this context, as far as we can know from this survey, the experience of the Italian MUSED project appears to be unique, because it is the only one strictly integrating the museum heritage with ICTs for science teaching purposes. Moreover, very differently from the majority of museums offering support to science teachers, MUSED provides access to non-digital-native objects, such as archeological finds, ad hoc digitalized and made available for educational treatment and exploitation. That is, on the other side, the reason why the experience from MUSED gave birth to EDMUSE EU project.
The main findings about this item are summarized in the table n. 2.

10. Isolated Initiatives

Another item of the outline was about initiatives promoting the creation of cross-disciplinary didactic units in the target countries. The partners provided data about several projects (tables n. 3 and 4 summarize the findings), but only very few of them can be considered relevant for the purposes of the survey, because of the project objectives, only broadly related to the focus of the project.

The Portuguese partner, for example, reported of a project about robotics and another (INQUIRY project) promoting outdoor activities for science investigations. This latter project gave the opportunity to mention explicitly the IBSE (Inquiry Based Science Education) method, that can be considered strategic for the overall EDMUSE approach.

The Italian partner mentioned three main web-based repositories, useful in case of creating cross-disciplinary didactics units but not focused on this directly, neither having a close link to heritage and ICTs in science teaching.

The Greek partner reported about a local network of schools, aiming at creating cross-disciplinary didactic units, based on various exhibits of the museum. This initiative seems to fit all the established criteria – cross-disciplinarity, heritage, ICTs - but we should need more details.

Regarding the evaluation of the impact for learning improvement, only the Portuguese partner could provide some information about a national initiative called "Curriculum Management: Experimental Science Teaching" and aimed at monitoring the development of experimental science teaching in the classroom and to evaluate the impact on students. At the moment of writing the country report this survey is still ongoing, so there are no available data about it.

In conclusion, we can argue that projects and initiatives in this field are actually available, but they represent isolated cases, i.e. not integrated and systemic, and mostly covering only partially the topics at issue.

11. Structural Issues

When asked to identify critical aspects regarding the topic at issue (see the Comparative Table n. 5), the Italian and Portuguese partners converged in considering teacher training strategic and crucial.

It is worth to read their own words, as they can depict effectively the situation, while highlighting key facets. The Italian partner focuses on the lack of uniformity in the teachers' digital competences:

Not all schools are equipped with technologies and multimedia laboratories and if they are, not all teachers have the skills to manage ICT. To date, there is a serious lack of uniformity in the ability of teachers to master the use of new technologies (Italian Report, page 8)

As the main reason for this gap, the Portuguese partner points out the scarcity of resources: reduction of investments, first of all, but also a reduction of time available, due also to higher level political choices, privileging other subjects:

[…] it is worth to refer as well that initial and in-service teacher training scarcely offer specialized and school context courses, especially for Social Sciences, and the computer resources available in the First Cycle schools of the AECC (and of other schools and clusters) are not enough to ensure its systematic use by students (Portuguese Report, page 5)

[…]

Summing up, during the last decade the teaching process in the First Cycle has been focusing more and more in learning of the Portuguese and Mathematics, especially due to exam pressure, which led to the reduction of investment in the other subject areas, in matters of training, time allocated and material resources. For instance, the study visits to museums and other cultural sites have been reduced. Currently, each class group visits a cultural place once a year (ibid.)

In contrast, the Greek partner highlights that primary teachers in Greece are systematically educated on ICT. First of all there are related subjects during their studies in all Greek Universities. Also the Ministry of Education has been organizing special annual seminars on ICT, LEVEL A and LEVEL B during the last 15 years.

Anyway, by taking into consideration all the collected information about this specific aspect, two out of three partners states that it is a critical issue. These observations conflict with the general conception and feeling that ICTs and digital competences are crucial:

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Teacher training on ICT tools (see the results of an European survey presented by Silvia Costa at the Conference Education in the Digital Era http://www.openeducationeuropa.eu/en/news/video-recordings-and-materials-education-digital-era-conference-now-online): 70% of the teachers consider important to use digital tools and resources in their classes but only 20% of the students are taught by digitally confident teachers (page 12)

12. Infrastructural Issues

What we read above - the first two quotations reported above from the Italian and the Portuguese Report - refers to another aspect of the problem, namely the scarcity of equipment – computers, in particular.
It is clear that those aspects are strongly interconnected: scarcity in investment reflects in insufficient teacher training and in insufficient and/or obsolete ICT equipment. But, as already pointed out, it can be ascribed to two different kind of reasons: an insufficient allocation of resources, in fact, can be the consequence of a precise political orientation, but also a consequence of scarcity of funding in itself, *notwithstanding* a positive political choice. Therefore, we have to distinguish the two aspects within the situations we have to analyze. Of course, the situation can be still more complicated, as it may seem from the data we collected: a general statement of importance of ICTs, digital competences and innovation in science teaching, conflicting with lack of specific indications and with a general scarcity of resources. This can mean, as well, a not so strong political commitment in this field.

There is another aspect to take into consideration, raised by the Portuguese partner, who highlighted the fact that BYOD methodologies – Bring Your Own Device – are not allowed at schools generally. We have no similar data from the other two partners, but we can argue that the situation is quite similar in all EU countries: BYOD is allowed only in very few cases, e.g. for specific projects or initiatives. As a consequences, teachers cannot rely on personal devices to overcome the shortage of equipment.
From the methodological perspective, BYOD based approach implies a global revision of didactics and the will to overcome "the plagiarism obsession". On the other side, the opportunity of using ICTs in such an extensive way for younger students can be questioned in many ways.

13. Organizational Issues

We can refer to organizational issues to take into consideration problems, already mentioned, about allocation of time – and the subsequent organization of the classroom timetable – and about educational policy, both at general and local level.

We can also take into consideration other kind of problems, as those identified by the Greek partner: legal issues regarding copyright and possible problems related to the content treatment.

Copyright issues have always to be taken into consideration when deciding to use digital objects from the web. This is why a platform as the Italian DIA database has been created (see Table n. 3). In general, when an institution provides access to its own heritage for educational purposes, it also ensure the possibility to use its copyright-free content, but terms of use must be carefully considered anyway.

This is what is pointed out by the Greek partner as a content-treatment related issue:

Could the various disciplines that we tend to integrate in a didactic unit contradict? E.g.: Teaching 8 year-olds about the fermentation, that is the chemical procedure which transforms must (from the grapes) to wine, could our reference to Mythology and Dionysus disorientate the students from our goal to overcome the mythic explanations and focus to scientific ones?
(source http://www.necsi.edu/research/management/education/teachandlearn.html*) (Greek report, p. 6)*

The issue concerns the possible conflict and consequent misunderstanding of some contents when we decide to use heritage for educational purposes. In the mentioned case, mythological explanations can disorientate students and prevent them from a scientific-based understanding of the topic.

Even if cases like this can actually occur, especially when dealing with ancient heritage, a sound overall methodological approach can ensure a proper treatment of those contents – that can provide, in turn, a richer experience to our students, and contribute to make them more open-minded and able to understand diversity in time, space and culture.

14. But it is still worth

In the previous sections, a summary of key considerations about the topics at issue has been provided. Most of the observations are about issues and concerns that tend to reduce the possible positive impact of initiatives like those proposed. Above all, there are problems of funding and policies, not necessarily depending on each other.

But, notwithstanding the negative points highlighted, the common feeling and certainty is that keeping investing - if not money, at least time and dedication – in experimenting new methods and approaches for science education, integrating ICTs and museum heritage, is still much worth, because it can actually contribute in innovating general science didactics and have a strong positive impact on learning outcomes.

That’s how the Italian partner describes the positive impact of the MUSED approach on the teacher community and on the students:

The proposed approach makes it possible to counterbalance the decline of educational disciplines and the existential impoverishment of the teacher positions by raising his professionalism. At the same time, it aims to provide students with a cultural proposal more appropriate to our times, on a European contexts. It supports more effective learning and expendable in the complexity of the company, in a perspective of greater responsibility of those involved. (Italian Report, page 8)

This conclusion does not deny the problems. In particular, there is the need to enlarge the impact of the initiatives conducted at local levels by scaling up them to upper, national and international level. In this perspective, the survey confirmed a common trend among southern European countries, that suffer from a more serious shortage of resources.

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Some Conclusive Observations and Recommendations

From the data collected and their discussion, we can propose some conclusions and recommendations for future initiatives and upcoming policies.

First of all, there is a widespread lack of uniformity in resource allocation, regulations and indications. There are many initiatives at local level, but they tend to remain isolated and not be integrated into a common framework. This issue affects negatively teacher training and professional development, because improvement and innovation processes tend to be entrusted to local, single, initiatives and to the good will of individuals.

As a consequence, common, **transnational and national common indications to be integrated into national curriculums should be promoted.**

There is a general lack of monitoring and evaluation systems at national and international level, so that it is very difficult to measure the actual impact of projects and activities and to evaluate their efficacy.

A common set of indicators, as well as a common and reliable data base, should be created and spread among policy makers, teachers and other stakeholders. This database could be usefully integrated with the PISA database.

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Science Education Learning Objectives - Comparative table n. 1

	Basic principles of science education	Group 1 Los: aged 6 or 8-10	Group 2 Los: aged 10-12	Subjects (G2)
ITALY	Survey method based on research, observation of the facts and their interpretation (general, for kids of all ages).	• development of the attitude to curiosity • explore phenomena with a scientific approach (observation and description of facts) • implement small experiments • identify quantitative and qualitative aspects in the phenomena • recognize the main characteristics of life of animals and plants • know the structure of human body • take care of body and environment • use of appropriate language to describe what has been experienced • find information and explanations from various sources	• explore, experiment phenomena and verifies the causes • develop simple schematizations and modeling of the facts • recognize in their body structures and operations • have a vision of the complexity of the Nature • connect the development of science in the development of human history • curiosity and interest towards the main problems related to the use of science in the field of scientific and technological development.	✓ *Physics* ✓ *Chemistry* ✓ *Biology* ✓ *Astronomy* ✓ *Earth Sciences*
GREECE	G1: observation, research, interpretation of various phenomena using a multi disciplinary approach; G2: basic knowledge and to appreciate the role of Natural Sciences in the human civilization.	"Environmental Study" • plants and animals • the movement of the sun and the moon • the function of the human body • the energy • the mixtures • the light • the soil • the Greek geography, use of maps and Greek ecosystems	"Investigating the natural world" Age 10 to 11: • Properties of material • Solutions • Molecules and atoms • Cells • Movement and Forces • Geology • Weight and mass • Human body • Energy • Light	✓ *Physics,* ✓ *Chemistry* ✓ *Biology* ✓ *Geography*

			• Sound Age 11 to 12: • Acids, bases, salts • Energy and its forms • Mineral carbons and natural gas • Energy in plants and ecosystems • Respiratory system and vision • Electro magnetism	
PORTUGAL	G1: […] contribute to the progressive understanding of the interrelationships between Nature and Society. Regarding Environmental Studies: […] diversified and meaningful learning experiences to ensure direct contact with the environment. G2: […] a learning by doing approach. The curricular guidelines relative to Natural Sciences specifically mention the appreciation of experimental tasks of various kinds.	Environmental Studies • The Self Discovery • Discovering the Others and Institutions • Discovering the Natural Environment • Discovering the Inter-Relationship between Spaces • Discovering Materials and Objects • Discovering the Inter-Relationship between Nature And Society		✓ *Physics* ✓ *Chemistry* ✓ *Biology* ✓ *Astronomy* ✓ *Earth Sciences* ✓ *History* ✓ *Citizenship*

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Experiences or Recommendations about cultural heritage and ICTs for Science Education – Comparative Table n. 2

	On CULTURAL HERITAGE	On ICTs	Key observations	KEY EXPERIENCES
ITALY	No specific indications MUSED	General indications about digital competence	- Mutual learning - Outside the walls - New media - Creative ways	MUSED The platform allows to browse the catalogue of Musei of Sapienza University and to produce hypermedia related to scientific heritage.
GREECE	No specific indications	No specific indications	Several projects are mentioned, but none is strictly focused on cultural heritage or ICTs for Science Educations	
PORTUGAL	No specific indications At a national level, the HERITAGE project (Património)	General indications about digital competence	Despite various initiatives, projects and activities around education for science and cultural heritage, there are still no systematic actions.	PATRIMÓNIO to promote Education for Cultural Heritage by conducting a series of joint initiatives, namely the School contest “My school take charges of a museum, a palace, a monument…”, the Kit Intangible Heritage Collection and the dissemination to the educational community of information on National Treasures of Museums da DGPC.

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Initiatives promoting cross-disciplinary didactic units – Comparative Table n. 3

	Initiative 1	Initiative 2	Key observations
ITALY			The DIA is a database of images that can be used in many different activities for schools and universities, for multidisciplinary research and finally as a specific resource for teaching with multimedia. http://www.indire.it/dia/cosa_generale.php CulturaItalia offers integrated access to the world of Italian culture. Digital resources are provided directly by those who own and manage the cultural content. Users, through the Portal, consult a base of "metadata", which aggregates and organizes information from all suppliers affiliated with Culture Italy. http://www.culturaitalia.it/ RAI website that allows the creation of lectures using audiovisual television. http://www.raiscuola.rai.it
GREECE	FIBONACCI project about ICT for Science Teaching in the Kindergarden		The Department of Cultural Education of Achaia in cooperation with the Museum of Science and Technology of the University of Patras, organized a network of schools to create cross-disciplinary didactic units, based on various exhibits of the museum. Many aspects of science and technology were approached through art, theater and music, such as the function of a pc, the function of the telephone and the radio.
PORTUGAL	INQUIRY project the Botanical Garden of the University of Coimbra (JBUC) developed manuals, educational resources and a teacher training course on the IBSE method (Inquiry Based	CLOHE project Uses mechanical moving toys (Automata) as a learning tool for	

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	Science Education) promoted in outer space to the classroom, such as the botanical gardens, which titled "Inquire Project: training in biodiversity and sustainability". These resources can be used in various fields such as biology, geography, geology.	primary students to build transversal key competences.	

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Innovative practices in science teaching and in evaluating the impact for learning improvement – Comparative Table n. 4

	SCIENCE TEACHING	EVALUATING THE IMPACT	Key observations
ITALY			No specific initiatives, only transversal projects and resources including parts/tools for science teaching and/or evaluation.
GREECE	See previous table	@wiki space (http://nikolaosmanesis.wikispaces.com/) primary teachers of Achaia share teaching material and educational practices on Methodology and Didactics on Physics (available only in Greek)	Several projects are mentioned, but none is strictly focused on cultural heritage or ICTs for Science Educations
PORTUGAL		INQUIRE Project	There are not yet systematic data for Portuguese educational system about the impact of different science teaching approaches and methods. However the General Inspectorate is carrying on a monitoring activity called Curriculum Management: Experimental Science Teaching aiming to monitor the development of experimental science teaching in the classroom, promote the improvement of educational practices and to contribute to effective science curriculum management with positive impact on the results of students.

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Issues & Concerns - Comparative Table n. 5

ITALY	There are organizational and infrastructural issues. Not all schools are equipped with technologies and multimedia laboratories not all teachers have the skills to manage ICT
GREECE	Sharing of the museum content in digital platforms isn't always possible, due to copyright related issues Could the various disciplines that we tend to integrate in a didactic unit contradict? E.g. : Teaching 8 year-olds about the fermentation, that is the chemical procedure which transforms must (from the grapes) to wine, could our reference to Mythology and Dionysus disorientate the students from our goal to overcome the mythic explanations and focus to scientific ones? (source, *http://www.necsi.edu/research/management/education/teachandlearn.html*)
PORTUGAL	There are not enough computers. BYOD is in general not allowed. Another problem is the time constrain, due to the need to focus on a dense curriculum and an exam driven system. Teacher training on ICT tools (see the results of an European survey presented by Silvia Costa at the Conference *Education in the Digital Era* *http://www.openeducationeuropa.eu/en/news/video-recordings-and-materials-education-digital-era-conference-now-online:* 70% of the teachers consider important to use digital tools and resources in their classes but only 20% of the students are taught by digitally confident teachers.

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