EdMuse – IO5
Guidelines and method for using Digital Cultural Heritage in education environment and evaluation
Education and Museum: Cultural heritage for science learning

EDMUSE

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1. General introduction: What are these guidelines for and how to use them?

Estudos prévios têm evidenciado que os recursos dos museus são ainda usados de forma pouco sistemática em contexto de aula e que as visitas aos mesmos nem sempre promovem as aprendizagens visadas, emergindo também a potencialidade das TIC de otimizar a utilização dos referidos recursos em contexto educativo. However, the relationship between school and museum, through the use of the scientific and digital realities that compose it, is both an expansion of training and a fun and valuable experience for the training of students and teachers. Especially the university museum is a place of integrated culture, based on the observation of objects and the possibility of interacting with them, where the student may track through the use of "exhibits", what he has learned, theoretically, in connection with the historical and artistic disciplines (DocVincenza).

Erasmus + Project "Education and Museum: Cultural Heritage for learning science" aims to promote innovative methods of teaching and learning through reusing digital learning objects of museums. This aim can be achieved though the characteristics of Edmuse platform that enable personalized and adaptive eLearning pathways.

In the scope of EdMuse, teachers are invited to plan "teaching" units on a topic of science, selected from among the contents of the programming for targets, so as to ensure the development of core concepts of the discipline in question in a multidisciplinary and transversal perspective. The goal is to give students the tools of understanding and intervention through the acquisition of skills as the ability to use the acquired knowledge (Doc. Vincenza). Integration with digital assets is useful when

1 “Problemi e prospettive di natura didattica” C. PIU, 2009 – Monolite Editrice
the teacher prepares his lectures. In this phase, the opportunity to gain access to the
digital resources of museums, constitutes a valuable support to capture images of
museum objects and information connected to content related to the topic discussed
in the classroom.

EdMuse methodology also allows teachers to build a custom path on line; using
programs or software products, they can create an e-book, according to a
communication strategy based on a continuous process of collaboration between the
museum and the teacher, according to which he can connect to the catalog of museum
objects, choose the content and the related images useful to describe the subject of a
curricular discipline, up to the use of a tool for the construction of the e-book, which as
we have seen, it makes it possible to integrate content related to digital museum
objects, previously selected and acquired through a custom path, dedicated to each
teacher.

The student, through the thematic routes and the observation of the museum object,
is involved in the discovery of ancient history, science, art and technology in a context
certainly more appealing than the classroom where daily lives his role to learner²:
peoples, events of the past, tools, inventions that have been realized through the
collections, the objects, the evidence preserved in the traditional and virtual museum
environment (DocVincenza).

In summary, teachers, thanks to the methodology proposed in EdMuse:
• acquire the skills to access the on-line digital resources of various museums;
• register on the website made available to create custom locations for the storage of
museum objects and the link information selected;
• trigger the download of custom locations on your computer;
• acquire the skills to organize content and the use of programs for the production of
lessons in ebook format;
• organize an educational trail on a topic of their program;
• segmenting an argument in paragraphs;
• report every paragraph in the form of node in building a hypertext map:

²S. SAPIA, V. FERRARA (2013). Al Museo per fare didattica. Education 2.0
Hypertext products will be made available on the platform, accessible to teachers and students with the goal of creating a virtual community for learning and building of knowledge (DocVincenza).

This output presents resources, methodologies and guidelines on how to reuse digital data museum in multimedia lessons.

It includes a Toolbox with resources for plan, implement and evaluate curricular units in the scope of EdMuse project. It also includes a Step by step guide on how to use these resources. Examples are also presented.

These Guidelines are target for teachers and should be used in flexible approach. It can also be accessed in

https://www.mindmeister.com/764245227

(at this moment, the mind map is not updated. I will update after your suggestions to this version of the guidelines.)
2. Toolbox for teachers to reused digital data museum

Toolbox includes a set of elements aiming to enable teachers to reuse digital data museum to plan and implement multimedia lessons.

These resources are divided in:

- Theoretical framework and key concepts for developing EdMuse.
- User Guides: EdMuse digital resources and how to use them, as EdMuse platform, Digital resources related to cultural heritage in museum to be used in EdMuse, software for the class plan.
- Curricular issues: Didactic and pedagogical resources, as Curriculum and Learning objectives/outcomes, methods.
- Piloting instruments: Research/Quality resources.
2.1. Museum Education and Natural Sciences Didactics: Theoretical framework and key concepts for developing EdMuse

2.1.1. EU recommendations for using cultural heritage in education
An inquiry based learning method, as proposed by Dewey, shall also be considered. Generally speaking, inquiry based learning stands for the learning process in which not only facts are explained but where questions, problems and scenarios are presented to the pupils. This learning approach can include a wide range of activities, such as case studies, field-work, investigations or research projects, among others. [http://www.scientix.eu/web/scientix-cop-02/ibse](http://www.scientix.eu/web/scientix-cop-02/ibse)

Depending on the role of the teacher and the learner in the process, different scenarios of inquiry-based method can be considered (Bell et al., 2005):

a) ‘Confirmation inquiry’, is the most strongly teacher-directed in which the student is provided with the most information. At the ‘confirmation’ level, students know the expected outcome.

b) ‘Structured inquiry’ - Students investigate a teacher-presented question through a prescribed procedure.

c) ‘Guided inquiry’ - Students investigate a teacher-presented question using student designed/ selected procedures.

d) ‘Open inquiry’: students formulate questions, choose methods and propose solutions themselves.
2.1.3. Focusing on the learner

In order to set our teaching goals we have to record the conceptual representation of the learner. An effective way to do it is to use concept maps. The EdMuse platform should provide a way for children to construct a concept map and to store it in order to reconstruct it in time, which is a crucial way to evaluate the learning process and the learning outcomes.

The study of the conceptual representation will lead the teacher on setting proper goals, focused on the special needs of their students.

2.2.4. Setting the goals

The conceptual representations recorded on the selected subject combined with the disciplines of the subject should lead to the definition of our set of goals.

2.2.5. Implementation of didactic units using museum digital resources

These didactic units consist of several educational resources, either text, or multimedia content. The teacher has the ability to upload and annotate the didactic units, the student the ability to download and extract the units in various formats and in accordance with her / his preferences.
2.1.6. Multidisciplinary projects

The design segment, in EdMuse project, involves the entire teaching staff in the construction of teaching units and not just the science teacher, since the objective is the creation of multidisciplinary digital material, focused on overcoming a teaching based on the transmission/receiving content, typical of ‘traditional teaching.

In doing so, it fosters a learning environment motivating and innovative and integrated teaching approaches, supported by collaboration between schools and museums\(^3\) that is based on use by students and teachers of objects belonging to the cultural heritage made available on the web and then reused (Doc. Vincenza).

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2.1.6. Concept maps

A concept map is a visual representation of knowledge. The process enables one to organize and structure information and the relationships between them. This may be done in a wholly graphical manner i.e. using images, photos, colour etc. to highlight differing concepts and their linkages or by identifying key concepts by name or title and enclosing them in a visual box then providing connecting navigation to lesser concepts. A traditional concept provides a hierarchical representation of the information from top down, whereas a mind map may radiate from a central single concept only. Suffice to say, when creating a spider map, systems map, concept map, mind map, flow chart, visual plan etc each performs a task that no ordinary collection of notes may encompass in a single sheet – a personal visualization of knowledge – and for our and the students perspective their key ‘learning gaps’ i.e. what it is they may wish to focus on, reflect, review and develop. In this way they may be used for as a tool to support and enhance learning.

2.1.7. Digital resources related to cultural heritage in museums

The EdMuse Platform collects the metadata of cultural heritage objects extracted from museum catalogues involved in the project and from the Europeana Digital Library extracted through the Sparqlutility.

- Europeana
- PMS catalogue (the repository of Sapienza University museums)
- Catalogue of Digital resources in the Science Museum of the UC I

2.1.8. Teacher competences
Teacher training

Important parameters on teacher’s training on using museum in education should be:

- Theoretical training on constructivism
- Theoretical and practical training on concept mapping as an assessment tool
- Theoretical and practical training on designing a multidisciplinary project
- Theoretical and practical training on:
  - Setting proper questions
  - Enhancing imagination
  - Use of proper language
  - Making comparisons and connections to prior knowledge
  - Giving proper instructions (Edson, Dean, 1994)

And finally theoretical and practical use of the EDMuse platform.
2.2. User Guides: EdMuse digital resources and how to use them


EdMusePlatform is a virtual learning environment based on collaborative work to share content and LO among many schools (IO2, p. ).

It aims to allow teachers to build a personalized path through web access to the Museums Catalogues and to download images and information on museum objects to be used in the production of multimedia lessons (IO2, p. ).

Different modes and content have been provided in a reserved area for teachers to make online lessons integrating museum objects.

Cards and catalogues are available on the EdMuse usable to any visitor who can look up and see what interests them; teachers and students logged in the project have an opportunity to create their own catalogues structuring specific paths in which they’re going to insert the objects of their interest; they have also the option to add other descriptions visible to all using the annotation tool.

UserGuide_Platform

Guideline to use EDMUSE Platform to search and download museum object image and content for reusing them in multimedia lesson.

You can access to EDMUSE Platform with this link http://www.edmuse.eu/edmuse-platform/index.php

You can access with login account and after you click on the collection for activating search engine in different cultural heritage catalogues.

As you see at the moment you can choose to search in Europeana Digital Library (but we are
studying the possibility to search in Galileo Museum or in other single database because the large amount of data sometimes doesn’t help the teacher to find useful content) or/and Art Collection.

1) You can insert the term or terms of search and click on the button. The system will show the results.
2) It can select the useful images for your work and the selection you can save it:

![Images selection screen](image)

3) The images and the content will be saved in the collection area and the user can manage them. In the page there is collection identifier and the user can click on it to open this work sector in the web page:
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[Images of search results from a database, showing records related to astronomy and the Austro-Hungarian North Pole Expedition 1872.]
4) The user can choose to select one or more items and manage them to activate remove or download option. If the user activates the download option the system allow user to capture images and content for its need.
The collection.zip contains HTML file of object form and images of museum object useful to reuse in the class with help of multimedia lesson.
2.2.2. User Guide of Software for the class plan (UserGuide_ClassPlan)
A personalized access tool to the Repository has been designed to allow teachers to build a reserved area to store the content and images related to the museum objects chosen. This digital content may be used to describe teaching topics through multimedia lessons (IO2, p. ).

The personalized catalogue is stored in XML format based on the RDF model. Teachers will be able to download this file onto their computer and also capture images of chosen objects. The XML file includes metadata based on Linked Open Data technology to allow access to object information, museum websites, and images by Hypermedia lesson. For re-using downloaded metadata and images, the tool ASD (Accessible Site Developer) Scuola, developed by Sapienza University, automatically builds a hypertext from content and is accessible via the web (IO2, p. ).

In this way, teachers will be able to explain the lesson with museum object images and information re-contextualized (IO2, p. ).
2.2.3. Copyright issues

As the core idea of EdMuse project is to reuse existing data about cultural heritage some issues about Terms of Use of each database used to develop multimedia lessons must be considered.

Below you can find links to Terms of Use of platforms.

**Europeana Terms of Use**


The Europeana.eu website is run by the Europeana Foundation and gives access to a wide range of digitised cultural heritage from across Europe and beyond. This material is provided to Europeana by a large number of contributing institutions and organisations. Europeana strives to make all resources on this website available for re-use. As part of this, **all metadata (textual information on digitised cultural heritage)** on the site are published **without any restrictions on re-use.** Most other material, such as the previews to digitised cultural heritage, is clearly labelled with rights statements that indicate if and under which conditions it can be re-used.

**Usage Guidelines for Metadata**


These usage guidelines are based on goodwill, they are not a legal contract but Europeana requests that you follow these guidelines if you use metadata from Europeana. All metadata published by Europeana are available free of restriction under the Creative Commons CC0 1.0 Universal Public Domain Dedication. However, Europeana requests that you actively acknowledge and give attribution to all metadata sources, such as the data providers (being a specific cultural heritage institution) and any data aggregators, including Europeana.

Give credit where credit is due.
- Give attribution to the data provider and all contributing data aggregators, including Europeana. Aggregators perform a crucial task in collecting, storing and harmonising data so that it is more widely accessible and interoperable.
• Make sure that others are aware of the rights status of the Europeana metadata and are aware of these guidelines. One way you can do this is to keep links to the CC0 Public Domain Dedication intact.
• If, for technical or other reasons, you cannot include all the appropriate source links and rights information alongside the metadata that you have used, you should consider including them separately, for example in a separate document that is distributed with the metadata or dataset.
• If, for technical or other reasons, you cannot include all the appropriate source links and rights information alongside the metadata that you have used, you may consider linking only to the specific metadata source on Europeana, where all available sources and rights information can be found, including machine-readable formats.
• Metadata is dynamic; consider using the metadata via the Europeana APIs or by linking.
• When working with metadata obtained via Europeana, please be aware that it is not static but subject to change. Europeana continuously updates its metadata to correct mistakes and include new and additional information. Therefore, the best way to use metadata published by Europeana is via the Europeana API or by linking to the specific data. If, for technical or other reasons, you cannot do this, then provide a link back to the source of the data on Europeana or implement an update mechanism.
• Mention your modifications of the metadata and make your modified metadata available under the same terms.
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• Any use of the metadata must conform to all applicable laws and other regulations in your jurisdiction, notably concerning (but not limited to) data protection, defamation or copyright.
• Be aware of any additional applicable community norms of data providers and data aggregators.
2.3. Curricular guidelines

2.3.1. Curriculum, learning outcomes & competences

Links to the National Curriculum for Elementary Education of each partner country shall be provided and a summary (IO1).

| National Curriculum for Elementary Education (IT) |
| National Curriculum for Elementary Education (PT) |
| National Curriculum for Elementary Education (GR) |

2.3.2. Teaching and learning method: constructivist model

In order to facilitate the full development of each student, it is necessary to provide an effective strategy for learning through various educational procedures.

Teachers must develop teaching learning scenarios on how to use the platform in a constructivist model. The constructivist teaching model for the Natural Sciences evolves into five phases and is proposed to develop EdMuse multimedia lessons:

- Orientation
- Promotion of children’s representations
- Reconstruction of children’s representations
- Implementation to everyday life
- Review

2.3.2.1. Orientation

- Concern of the teacher: to challenge students' interest in such a way that they feel the concept negotiated concerns them.
- The stimulus must be appealing and targeted to multifaceted (emotional and cognitive) engagement of the student.
- The platform can accommodate such stimuli
e.g.: a lesson concerning earthquakes could involve excerpts from the TV news about the recent earthquake in Italy (emotional involvement) as well as comparisons with earthquakes with similar characteristics that had different consequences (cognitive challenge). It can also suggest orientating activities.

- The use of interdisciplinary stimuli can reinforce the impression caused e.g. a collection of newspaper headlines or a photographic collage of the events of an earthquake can contribute to this.

2.3.2.2. Promotion of children's representations

- Dialogue is sought to enable students to explain their views.
- Trying to explain, the student is forced to organize what he/she thinks and thus perceive possible confusions. They also have the opportunity to compare the views of their peers.
- The platform can help at this stage by providing users a tool for constructing (and storing for later comparison) mental maps which will facilitate the written recording of students' views.

2.3.2.3. Reconstruction of children's representations

The class checks the correctness of their ideas with scientific documentation, that is experimentation and the so-called guided discovery approach.

At this point the contribution of the platform and the museum exhibits can be decisive.

The exhibits and their observation contribute to the discovering of the scientific principles and laws labeling. Choosing the right exhibit and the didactic handling with proper presentation and appropriate questions will lead to reconstructing the previous views into scientific representations.

The platform may include proposals for teaching manipulations of exhibits or suggestions on the suitability of each exhibit for the reconstruction of certain erroneous representations of the students.
2.3.2.4. Implementation to everyday life
The ability of the new cognitive achievements to solve problems of reality with the scientific process is judged– checked.

The variety of everyday sectors in which everyone meets science applications can be served by the interdisciplinary approach.

2.3.2.5. Review
The students compare their initial ideas to their reconstructed ones and a cognitive imbalance arise. Discussion leads to conclusions adopting the new knowledge.

2.3.3. Other pedagogical issues

2.3.3.1. Teacher questions

2.3.3.2. Assessing Concept Maps
A method of assessing Concept Maps proposed by Novak and Gowin in 1984 is based on the components and structure of the map. This system awards points for:

- Valid Propositions (1 Point Each),
- Levels of Hierarchy (5 Points For Each Level),
- Number of Branchings (1 Point For Each Branch),
- Crosslinks (10 Points For Each Valid Cross-Link),
- And Specific Examples (1 Point For Each Example).

2.4. Piloting/evaluation tools
Concurrently with the construction of Unity Teaching is useful prepare the piloting/verification tools: questionnaires with multiple answers relating to chosen topic and other instruments that can monitor learning processes and outcomes and other motivational indicators.

2.4.1. Pre and post questionnaires and concept maps addressing students learning
The structure of the questionnaires is the same that teachers usually use during the school year as a verification tool to test knowledge, previous and acquired by students.
The questionnaires are administered in two times: before and after the Learning unit is carried out.
By administration of the initial questionnaire occur the basic knowledge, all the information that the student possesses regardless of notions provided by the school and are the result of input and stimuli that he receives from his family and the social and environmental context in which they live these skills are the so-called "cultural baggage." At this stage, students should also develop a first concept map that illustrates their views about the topic.
The final verification questionnaire will assess the abilities and skills acquired by the students and will reflect the degree of learning achieved as a result of multimedia lessons (comparing pre / post within the class).
Another concept map should also be produced representing students views about the topic.
2.4.2. Pre and post questionnaires analysing motivation before and after developing the tasks

An initial questionnaire will also address students’ expectations, attitudes towards science topics, motivation and self-efficacy when learning science.

At the end of unit, students will answer the questionnaire again.

2.4.3. Teacher log book

2.4.4. Analysis of students produced tasks/collections - Identifying different paths.

Students produced tasks/collections will be described and analysed-

2.4.5. Other instruments

2.4.5.1. Students

  o Observation of students’ behaviour and questions during museum visit.
  o Questionnaire – Learning and satisfaction after museum visit.
  o Test to students (3 months after the lesson and including metacognition dimension).
  o Swot analysis

2.4.5.2. Teachers

  o Analysis of teachers plans, behaviour and attitudes (before and after).
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- Plans
- Swot analysis
3. Step by step guide for teachers to reuse digital museum learning objects and implement multimedia lessons

The Step by Step Guide aims to present general guidelines for teachers on the use of EdMuse platform to implement multimedia lessons aiming to involve students and stimulate their curiosity in science subjects.

A teaching action, built in order to make significant the learning context, is based on the following scheme:
To plan and implement multimedia lessons aiming to reuse museums digital resources, teacher should follow some steps:

3.1. Choose topics, considering national curriculum and key-words of EdMuseto promotecrossdisciplinarity.

The team organizes an educational trail on a topic of science in accordance with the disciplinary content belonging to the basic curriculum, which connects other disciplines transversally and can do acquire different skills (Doc.Vincenza).

- The topic considered should be included at least in two disciplinary areas.
- In 5th and 6th grades, at least two teachers must be involved.

3.2. Establish learning outcomes and competences

Substantive knowledge, procedural knowledge and competences must be considered.

Formulate learning outcomes and competences considering national curriculum.

It should be considered that EdMuse methodology also favors:
EDMUSE

a) *capacity for action*, the student is the protagonist of their own learning, interacting with objects and subjects, produces something new with your own activity;

b) *metacognition*, the student is led to reflect on the cognitive processes and learning strategies that activates;

c) *collaboration*, the student must take into account the resources made available from the others because from the proper use of these derives the quality of the product that achieves;

d) *culture*, the student learns and shares a way of life and thought, producing work with others (Doc. Vincenza)

3.3. Become familiar with EdMuse platform

In the construction of interdisciplinary multimedia products, the on-line access to EdMUSE platform, through which you can create multi-disciplinary connections in media mode, allows, once the teaching units are defined, to use the resources of the museum heritage, following the choice of development and deepening of the teachers on the subject chosen.

The EdMUSE platform allows you to capture useful information to build lessons or research in hypermedia format. The captured information can then be integrated with other content using different programs: PowerPoint, FrontPage or any text and graphics editor that allows you to save in HTML (Doc Vincenza).

3.4. Select images and other learning objects presented and introduce them in the Plan

During the research of materials, it is useful to register at EDMUSE, collaborative and open platform, achieved by the use of open data technology, aimed at making accessible, to teachers and students, digital cultural heritage resources made available in open mode by museums (Doc. Vincenza).

Registration and access to "My Catalog", allows you to store search results and reuse the same for learning content. The complete search takes longer but provides feedback of the terms also sought in the annotation fields and descriptions (Doc.
EDMUSE

Typing a word, it will be searched in the title, in description or in any annotations of digital resources, so you activate the search for one or for all institutions that have provided their digital heritage.

3.5. Develop hypertexts

Design a teaching unit through a hypermedia map, which will have as a hypertext final product, provides for the planning of the project according to the following scheme:

- Each paragraph is listed as a node in the hypertext construction.
- Each node provides historical, geographical, scientific information related to the subject that gives title to hypertext and in each node will be inserted images selected from the catalogs of museums in support of information page.
- The hyperlink path made by teachers, made of texts and images, enriches the lessons, creating a highly stimulating and motivating learning environment for
students and teachers. Hypertext is a document through which you can switch
to the other information in a simple and immediate means of hyperlinks
(links), using multiple media simultaneously, integrating them into a single
communication object: text, images, sounds, movies, animations, etc...

In this phase, teachers develop a concept map, defining learning experiences and
students’ tasks to be developed in class and at the museum, taking in account the
strategies proposed in the Teaching and Learning Method Toolbox (or is this foreseen
in the platform?).

The realization of a concept map, during the design phase, helps teachers to graph
their knowledge about the subject:
• identify the concepts
• proceed to the creation of the associative relationships between them (words-
  node),
• to relate the different concepts in a clear and correct way (word-bond)
• each concept - map node represents one or more pages of hypermedia

To plan the lesson, teacher should follow step involved in constructivist teaching
method as Orientation, Promotion of children’s representations, Reconstruction of
children’s representations, Implementation to everyday life, Review

To plan the lesson, teacher should follow step involved in constructivist teaching
method as:
• Orientation
• Promotion of children’s representations
• Reconstruction of children’s representations
• Implementation to everyday life
• Review
3.6. Gathering data: Pre test (students)

Pre test (Learning and motivation indicators. A concept map is developed).

3.7. Implementation of the multimedia lesson following a constructivist method

To implement the lesson, teacher should follow step involved in constructivist teaching method already referred:

- Orientation
- Promotion of children’s representations
- Reconstruction of children’s representations
- Implementation to everyday life
- Review

During this process students should explore the platform, download and extract the units in various formats and in accordance with her / his preferences and construct their own student model.

3.8. Gathering and analysing processes and outcomes

- Gather data about students’ behaviour, questions, exploring paths (with us?).
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- Gather data about students learning and satisfaction.
- Analyse students’ tasks (with us??).

3.9. **Visit to the museum**

4. Preparing the visit

5. Gather data about students’ behaviour, questions, exploring paths (with us??).

6. Gather data about students learning and satisfaction.
4. Cases/Examples

Cases from the implementation of the project (evaluated, examples)/Descriptions in didactic way are presented in this section.

4.1. Example of e-book made by teachers of science, history and technology in two classes of primary school, using the museum digital resources, downloaded from musEd platform and CSM asd.scuola:

*Dalla vite al vino*

**Mappa - Contatti**

- Home page

**Dalla vite al vino**

**ISTITUTO COMPRENSIVO VIA MICHELI**

classi IV B e V A G. RONCONI e IV B G. ALESSI

Primaria

materie: **SCIENCE-ART-HISTORY-TECHNOLOGY**
Terminologia specifica
Dall’uva al vino
Storia
Usi
ALCOL E SALUTE

docenti: MARCELLA MESSINA - ILARIA ROSA - ALESSANDRA MAURO

Selected images from the catalogs of museums, included in each node in support of information page

Vite - Erbario - Museo di Botanica
In the construction of interdisciplinary multimedia products, the on-line access to EDMuse platform, it gives the ability to create multi-disciplinary connections in media mode by downloading the museum objects that belong not only to science museums, but also historical and artistic museums. The close connection between history, geography, science and art, made possible by the connection between information placed in different parts of the same document, allows a global approach and reticular knowledge, through the identification of contact points (nodes) among the content of the various disciplines.