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Semantics, Ontology and Information Systems in Education: Concerns and Proposals

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The Web Site “Didactical Materials for Latin Palaeography”

It was planned and implemented to let students access and use various kinds of didactical materials (Cartelli & Palma, 2005). It is made of three sections and which contain:

- **plates**, reproducing charters in ancient manuscripts (texts written in the various Medieval scripting styles). Together with these images, their translations are reported (i.e., digital full texts where symbols, special signs and abbreviations are clearly written)

- **texts**, with full or partial documents reproducing papers, presentations and articles on different discipline topics, such as book archeology, scripting styles, cataloguing, history of paleography etc. (made available from the authors for didactical purposes)

- **works in progress**, where special documents are placed; they are mostly devoted to work group experiences. These documents are in fact managed by students attending the course.
Site and students’ evolution (.. and problems):
The site (first made in 2001) is continuously increasing in its size for the addition of new documents. It has always been used from M. Palma to support the lessons of Latin palaeography and the author could analyse students’ work due to their small number (in the best case they were 19 otherwise they were from 6 to 17).

The most relevant result is the change in students’ behaviours over time (i.e., in the way they access didactic materials in the site has changed):

• the students accessing the site in its first stage (i.e., when there were only a few documents within it), usually read all available texts and did this on their own,

• now, with more than 72 documents and 211 plates (with their translations), students mostly limit their reading to the texts the teacher suggests during the lessons and do this only when they are explicitly invited to do so.
Students and information retrieval:
Students have difficulty in finding the “right documents”; when they need information for solving a problem or studying a topic, they go to the site, try to locate it in the right section, and start reading the document they suppose to be useful. Very often they are forced to read more than one document before finding the right information and, sometimes (often), this time consuming job prevents them from ending the research and finding what they were searching for. These behaviours are confirmed from the results to a survey made at the beginning of academic year 2005/06.

Tab. 1 – Distribution of students successfully accessing the right pages in the site

<table>
<thead>
<tr>
<th>Success in accessing the right document in a fixed time</th>
<th>N. of students</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Succeeded before the deadline</td>
<td>3</td>
<td>25%</td>
</tr>
<tr>
<td>Succeeded after the deadline</td>
<td>5</td>
<td>42%</td>
</tr>
<tr>
<td>Didn’t succeed in finding the right document</td>
<td>4</td>
<td>33%</td>
</tr>
</tbody>
</table>
Discussion of the results obtained with palaeography students

In the author’s opinion the situation described for the students of palaeography is very similar to the one people encounter while searching materials on the Web. When search engines were firstly introduced, the finding of information seemed easy, but now, notwithstanding the growth of the number of search engines (very different among themselves for their features), we know that things are not so easy and the above problems are far from being solved.

Many authors suggest that the reason for the above difficulties is the fact that **word matching doesn’t guarantee the right result for a given search.**

As an answer the semantic web has been proposed to solve the problem.

To give the semantic web a pedagogical perspective, within which to consider the effects the web can have on individuals’ knowledge construction and development, two themes need a deep analysis:

1) **instruments for giving semantics to the web** and their possible educational application,

2) **models for knowledge construction and evolution** in mankind and their consistency with the semantic web.
Semantic Web and pedagogy

Semantic Web usually depends on instruments and strategies for enabling computers to 'understand' web pages. As Koper (2004) states there are many instruments to do it (Latent Semantic Analysis, Ontology Web Languages, RDF and RDF-Scheme, Software Agents, Topic Maps, UML and XML languages) and they can be very useful in education.

Main questions with them are:

1) it is very difficult to find a correspondence between the representation of knowledge emerging from the use of the above instruments and the constructivist models for knowledge development (there is a great difference between knowledge representation and knowledge construction as showed from the studies on misconceptions and mental schemes)

2) the above instruments are not enough flexible and adaptable to guarantee the representation of knowledge evolution with its paradigmatic changes (as an example consider Ontologies: when new scientific paradigms are introduced for interpreting phenomena the creation of a new ontology is needed).
A model for Knowledge construction and evolution

Fig. 1 - Hypothesis for the structure of human knowledge
Pros and cons in the adoption of the above model

**Pros** - when looking at knowledge phenomena from a constructivist perspective the above model can be applied to all contexts: individual, community and society, and succeeds in explaining them.

**Cons** - when the application of ICT in education is analyzed we have:
- Learning Objects (LOs), usually adopted for managing students’ interaction with discipline structure (which have only the individual and the social/scientific knowledge units as reference element in the model),
- Units of Learning (UOLs), which implement learning activities within the learning objects (Koper, 2001) (which have once again both the individual and the social units of the model as reference elements),
- Computer Supported Collaborative Learning Systems (CSCLS) and all e-learning platforms implementing synchronous and asynchronous communication instruments and strategies to support communities of learners (and/or of practice) (which have the community unit of the model as reference element),
- Semantic web and Domain ontology systems (which directly refer to scientific/social knowledge in the model)
Information Systems and Semantics on the Web

In the author’s opinion information systems can play a relevant role both in introducing semantics in the web and in building effective educational experiences. At the basis of this hypothesis there are two kinds or arguments:

a) the experiences the author had with on line information systems (dynamic web sites interfaced with databases), which led to the construction of communities of learners and of practices, and confirmed the structure of the model reported in the above section,

b) the increased awareness of the importance of human interaction with automatic systems for data analysis and management on the web.

As usually happens with all information systems the explanation of the whole project and the description of the system itself both involve the following elements:

a) data and their structure,

b) subjects and their interactions,

c) data flow and processes description.
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The structure of the on line information system
The diagram below reports the basic elements for the information system

- **System Administrator** (can do all operations on data in the system)
- **Scholar/s - Scientific administrator/s** (create account for contributor/s and student/s, manage knowledge domain data and validate them)
- **Contributor/s - Student/s** (manage knowledge domain data by compiling suitable cards)
- **WEB Server interfaced with a RDBMS containing the ontology system**
- **General user** (queries the system and obtains validated data in a suitable graphic format)

**Fig. 2 - Users accessing the system and authorized operations**
The Information System and the model for knowledge construction

The key for the success of the system is in the communication subsystem (all the communication instruments the Internet makes available). It lets people involved in the creation of the database (domain ontology) share their experiences and knowledge, finding support and help among themselves.

Fig. 3 – Model of knowledge construction according to system’s access