E-learning content 'usability': semiotic and didactic parameters in digital texts and textuality

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Abstract

The paper deals with the notions of e-learning content digital texts and digital textuality as design guidelines for the development of didactic materials in the light of semiotic and psycholinguistic approaches. A typology of didactic texts/goals and the cohesive relation between language and visual components in didactic tutorials as far as reception, comprehension and finalization of content will be dealt with. The semiotic and didactic assumptions will be theoretically illustrated and discussed through the analysis of a number of online demo referring to maths, medicine, and economic sciences presentations.

Conclusions on the need for design implementation of e-learning content will be summed up through a specific checklist of semiotic and pedagogical features for e-content development.

Keywords: e-content semiotics, e-learning textuality, didactic digital texts, iconic-linguistic relation

1. Theoretical and applicational issues in e-learning content development

As I proposed in earlier contributions, the pedagogical approach to e-learning is basically influenced by e-learning technology (Zuanelli, 2003).

Learning processes through e-learning technologies roughly include: HW, SW and web infrastructures that support learner’s activities of communication and interaction with other subjects of the learning community: teachers, tutors, other learners, etc. as well as with electronically supported didactic material (i.e. e-content/learning objects, etc.): synchronous and asynchronous software and multimedia services, courseware, etc.), on one side; on the other side LMS/LCMS and pedagogical platform services: teleconferences, forum, FAQ, blogs, etc.; administrative services; didactic services: enrolling, tests administration, etc.

As a consequence we can state that:

- e-learning contents are basically influenced by their technological HW/SW infrastructure; e-learning implies use and reuse of materials requiring innovative ways of didactic interaction. These innovative electronically based procedures positively influence learning processes but at the same time pose new problems as regards the multimedia integration of the didactic message and of the learning objects;

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- electronically supported didactic messages and learning objects imply a brand new attention to different methodological procedures as preconditions to perception, memorization and learning itself;
- e-learning requires a prospective definition of new learning paths in order to take care of the didactic integration of different media and content.

Core specifications for the integration of multimedia multicultural e-learning content may be summarized as follows:

S.1 classification/organization of e-learning content
S.2 definition of methodological criteria for a structured elaboration of courseware in the perspective use of content within a platform, with or without the aid of a teacher and/or tutor
S.3 definition of final, intermediate and immediate didactic objectives and tasks in different thematic and functional e learning paths
S.4 finalised elaboration of didactic content as different from free content
S.5 methodological description of learning units/learning objects as related to S.2
S.6 methodological orientation to e learning paths as related to approach, method and techniques
S.8 LMS specification of different learning services for different end users
S.9 elaboration of tools for guided learning paths and courseware: informative, operative, transactional units and typologies of e-content: e-books, e-papers, videos, etc.
S.11 supply procedures: on line, off line, print, download, etc.
S.12 communicative interfaces for didactic interaction
S.13 didactic metacommunicative and metalinguistic guides: instructions, introductions, applications, etc.

These specifications would require the following modeling of e-content:

Table 1. Methodological specifications for e-learning content usability

<table>
<thead>
<tr>
<th>Psychological modeling</th>
<th>goals</th>
<th>approach</th>
<th>content</th>
<th>method</th>
<th>activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>e-based modeling of didactic communication/learning support</td>
<td>type of didactic communication/learning support</td>
<td>multidisciplinary approach</td>
<td>definition of learning paths</td>
<td>method/content</td>
<td>didactic techniques/e learning tools</td>
</tr>
<tr>
<td>modeling of didactic electronic interface learner/machine (accessibility/usability design)</td>
<td>multifaceted web design</td>
<td>approach</td>
<td>learning architecture</td>
<td>communicative interfaces for didactic content and interaction</td>
<td>didactic electronic devices</td>
</tr>
<tr>
<td>self-directed learning</td>
<td>aided/self-directed learning</td>
<td>content presentation</td>
<td>didactic techniques</td>
<td>metalinguistic activities</td>
<td>structured/unstructured content</td>
</tr>
<tr>
<td>a semiotic approach to interface design</td>
<td>syncretic elaboration of audio-visual materials</td>
<td>content development</td>
<td>textual-ICONIC typology</td>
<td>function of language content and metalanguage</td>
<td>techniques of didactic presentation</td>
</tr>
</tbody>
</table>
1.1. The notion of e-learning usability

The literature on the subject (Ardito et alii, 2006) sums up different approaches and confirms that the theoretical field is largely conditioned by a juxtaposition of different items subsumed under the notion of e-learning usability (accessibility) such as:

- usability of platforms (LMS and LCMS): functionalities for pedagogical activities
- usability of didactic e-content namely courses/modules in an overall path (structured or unstructured: the sequence of didactic templates, containing didactic functionalities)
- usability of instructional content for achieving didactic goals: structure and sequencing of units/content, didactic elaboration of texts, images, videos and the sincretic structure of materials.

The notion of usability in this paper does not refer to LMS or LMCS. It refers to e-content didactic structure and interface of courses and tutorials as developed into texts, having to do with on-line content presentation whether within LCMS or on other platform supports.

As we shall demonstrate, e-learning content development generally lacks a number of instructional specifications needed for on-line interaction. In particular:

- the lack of didactic metalanguage and psychopedagogical tips for learning activities
- clear definition/perception of didactic goals in the course and in a unit
- thematic and functional interactional cues in words or icons
- thematic environment (maths, computer science, medical science, economy, etc.)
- typology of texts as related to learning content goals: informative, procedural, transactional (what the learner will get as a result of learning materials and suggested activities)
- finalized typology of e-content texts: descriptions, comments, observations, generalizations, etc.
- audio-visual textuality.

E-learning context usability

An overall appreciation of an e-content context should take into consideration a number of usability variables such as e-learning functionalities, namely didactic activities provided by the course/units/materials; typology of pedagogical texts and related textuality; semiotic communication syncretism of different codes (written and/or oral language, images, drawings, videos, animation, pictures, etc.); clear finalization of messages as related to comprehension, memorization and retrieval for use, both theoretical/conceptual and/or applied/operative. All together these features of instructional design should appear in e-learning digital texts as provided in visual/auditory displays.

E-learning content structure usability

As for the architecture of the course/lessons display, we should consider a hierarchical, relational and linear sequence of contents: for instance, the possibility of navigating through the course moving from one specific page to related links and moving back without losing context. This implies the definition of the e-learning context to be related to the course functionalities and the permanent visual contextualization of the learner (see a 'dated' example in www.pragmema.it, home formazione, ecdl, pedagogical database of courses and free demo, 2001).
E-learning didactic structure

Key didactic parameters, in general (Zuanelli, 2009a), as preconditions for the effectiveness of learning goals in content structure are:

- the preliminary definition of the learner's background knowledge
- metalinguistic tools for the language of presentation
- didactic meta-communication having to do with the cues and explanations of learning tasks and learner's expectations
- e-learning typologies of digital multimedia texts and related digital textuality.

1.2. Internet design: e-learning text typologies and digital textuality

The notion of text in linguistics defines a text as an oral and/or written sequence of phrases. These phrases respond to a number of textuality parameters, the most important of which are logical-semantic coherence and related cohesion (deBeaugrande & Dressler 1983).

Cohesion refers to language means used in the production of texts. A typology of texts regard linguistic communicative functions realized (informative, narrative, descriptive, argumentative, didactic, etc.) and pragmatic/performative functions as well (deBeaugrande & Dressler, 1983; Zuanelli,1981, 2006, 2009b). From a communicative viewpoint, the possibility of integration of oral, written and iconic components of texts poses a semiotic theme that we may define as the cohesive syntactic functions in icons and words (Zuanelli, 2009b, 2013) or else the syncretism of the visual components, written language, graphics, drawings, videos and oral language as well. This is partially the object of the studies in semiotics of interface design (Ferreira, 2005; Ferreira J., Noble J. and Biddle R., 2005; Zuanelli 2009b, 2013).

In digital communication (Zuanelli, 2006, 2009b, 2012), the identification of pragmatic functions in digital interaction is assigned to the notion of digital text.

A digital text is the integration of the pragmatic component having to do with the functionalities of a program/software, the macro-act, with the content to which functionalities are applied, namely the electronic text (Zuanelli 2009b, 2012). The integration of the two allows for a specific definition of usability parameters in web design.

A first look at icons as present in graphical user interfaces (GUI) of sites, informs us of two basic things. First, icons and words define both the context of interactions and the actions suggested for interaction to users. The context is generally rendered through a visual and linguistic metaphor whereas actions are conferred to visual metonyms. Second, graphical interfaces use different functional typologies of visual information: graphs, icons, colors, space, etc. with the implication that 'concrete', better said 'figurative' icons, as well as already known visual information are better understood than 'abstract' or new ones (Dormann, 1994; Ferreira 2004).

Digital textuality includes a number of information visual elements as appropriate to digital interaction according to knowledge and communication architecture (Zuanelli 2006, 2009b).

I consider e-learning content software as a specific application of digital communication.

In an e-learning perspective, digital texts correspond to e-learning software as developed in courses and tutorials for pedagogical interaction.

The psychological coexistence of multimedia and multimodal integration of content (Kumar, 2007) is a crucial point and requires a semiotic and psycholinguistic approach to e-content development.

If we limit our analysis to the relation of linguistic-iconic texts we can detect at least the following criteria for the analysis of digital multimedia textuality.

Textuality parameters, besides coherence and cohesion, suggest that the virtual situation of interaction, namely a didactic one, has to do, specifically, with the informativity of texts and their acceptability on behalf of addressees. This implies, as well, attention to specific variables of age, dual information processing, etc.

In general, text coherence as related to linguistic-iconic contents allows for the following modalities of cohesion.
Linear cohesion, can be defined as the sequence of images straightly related to an oral text: it is the case of descriptions, informations, comments, namely representative pragmatic speech events having to to with transference of conceptual meanings related to principles, notions, situations, etc.

Relais (Barthes, 1964) cohesion has to do with an alternated sequence of words and images where words let images proceed and viceversa (as in narrative texts, movies, cartoons, etc.).

Procedural cohesion is a specification of relais cohesion that is needed in interactive stimuli for operative and transactional cues where an oral, written or iconic information require the user's response to proceed. Redundant cohesion has to do with the referential or performative (directive) function of oral/written language as matched by a visual metaphor/metonym: the photographic translation of an object (the concept of 'car' as an instance of 'goods' in economy) or metonymic icons for performative functions, i.e. the image of an X for closing, an oriented icon to proceed or the icon of 'file' for opening a file (Zuanelli, 2009b, 2012).

For the development of didactic digital contents, I propose a simple typology of didactic functions/goals having to do with related digital texts and textuality in content presentations.

Informative goals have to do with the presentation and description, comment of specific knowledge: historical, economic, mathematical, etc. The audio-visual development presents a number of solutions such as the auditory and/or written explanations matched with drawings, graphs, pictures, as in a face to face presentations aided by traditional technologies. The conceptualization of received information may process facts, principles, notions as related to a specific discipline.

Operative goals have to do with texts that translate received information into an operative task and therefore include directive cues: how to perform a maths addition, how to make a medical diagnosis, how to perform a computer task.

Transactional goals relate to digital texts that imply a complex interactional task either conceptual and/or operative in a complex computer event virtualization (a statistics elaboration, the solution of a maths problem, the writing of an electronic text).

Digital textuality in transactional goals corresponds to the functional virtual environment for different simulations and tasks: 'an addition for a bill in a restaurant', 'a medical diagnosis in a hospital', 'a desk invoice for a professional accountant' are instances.

2. Case studies

The analyses of demo examples of online tutorials/courses offer a 'field' analysis of presentation problems in e-learning content textuality as follows.

Case study 1.

The presentation of measurement language for weight in comparative terms:
Grade 1: Mathematics curriculum/measurement, state of Louisiana (www.link2math.com/demo)
Objective: " Use of comparative and superlative vocabulary in measurement settings (e.g., longest, shortest, most, hottest, heaviest, biggest)"

As we shall see, the iconic animation, auditory and written support are meant to represent and explain weight comparison as correlated with specific nomenclature to be learnt.

We may guess the didactic objective is twofold: understanding the conceptual difference in weight comparison and acquiring the linguistic skill in maths nomenclature: light as opposed to heavy, heavy as opposed to heavier.

The presentation is assigned to an animated video governed by a linguistic oral/written representation of the notion followed by questions of knowledge elicitation/verification and tasks of specific measure nomenclature.
**Presentation:**

iconic animated text1: narrative (informative goal)  
auditory text1: dialogue related to narrative event  
auditory text2: directive didactic dialogue (operative task)  
written text 2: representative words/phrases (referential function + representative function of nomenclature)  
iconic text 2: referential representation of objects and animals

The video animation presents a boy and a girl in a car.  
The car gets stuck.  
The girl gets off and tries to push the car.  
She asks the boy why she does not succeed in doing it.  
The boy says that the explanation, a **larger weight**, can be given by answering a few simple questions. Here comes the directive text in the form of questions and answers,

**Questions**

The video shows an **elephant** and a **deer** (in a balloon **visual format**); the boy asks which has a **larger weight**.

Fig. 1. Question on animals size
The drawing opposes two labels appended to the two animals: **large** versus **small**. The visual and conceptual implication seems to be that 'large' has to do with 'size'. The girl answers: "the elephant".

Then the boy asks which is **lighter**: a **car** or a **bicycle**. The drawing opposes a **car** to a **bicycle** and opposes, as well, **lighter** to something not defined as heavier. The girl answers: "a bicycle".

Finally, the boy asks the girl to think of different human actions: holding, pulling, pushing, lifting. He shows four images that oppose 'light' to 'heavy', as related to different actions. We suppose the implication is a relation of cause-effect (if **light** then **holding**), (if **heavy** then **pulling, pushing, lifting**???)  

**Light** is opposed to **heavy** through the different actions as related to different objects. The implication here would be that certain objects are **heavy** and other ones are **light** as related to actions. However, the conceptual effort is threefold: an auditory and visual correlation, the reference item **light** as opposed in the three examples to **heavy** objects whose context may be misleading, the correlative comparison of weight.
In fact:
The man **is holding** a ball, that is light
A woman **is pulling** two bags (why not one?) that are heavy
A man **is pushing** a car, which is heavy
A boy **is lifting** dumb-bells, which are heavy too.

The comprehension needs the activation of a number of suggested iconic and linguistic inferences.
If you drag/pull something, then that something is heavy; if you push something, that particular something is heavy; whereas holding a ball is naturally a light task whilst lifting dumb-bells requires an effort because dumb-bells are heavy.
The implication is that when one does something with an object, the weight may be light or heavy, according to the object, depending however on human activities you are engaged in.
The task is threefold: an informative conceptual task, an operative one, namely the measurement comparison, and the linguistic skill for denomination of concepts.
On behalf of students, the 'logical' sequence of presentation needs iconic inferences as well as linguistic ones, which do not seem coherent.

Let's see:
**larger weight** (measure) as applied to a car;
**large-small** opposition as applied to **size of animals/objects**;
**lighter** as comparison of two objects of different size and weight, a bicycle and a car, of different weight;
**light**, the ball, as opposed to **heavy weight** referring to human actions and objects.

The non-coherent confusing inferences implied are:

- non positively redundant inferences between codes (iconic and linguistic)
- erroneously related concepts (**weight** is not necessarily related to **size**, in any case):
  - elephant versus deer **yes**
  - car versus bicycle **yes**
  - dumb-bells versus ball **no**
- with the plurality/polisemyc of meanings of icons and words: **larger** is referred to size (elephant) and **measure** as well (**larger weight**, namely **greater than**).

Finally, the lexical semantic dissymmetry should take into considerations **language relativity**, having to do with the mother tongue of students and the filter effect:

Italian **alto** is opposed to English **high** and **tall**
Italian **basso** is opposed to **low** and **shallow** and **short**, etc.

This analysis reveals a considerable number of problems as related to the compliance of iconic-linguistic didactic goals, whether conceptual/informative, operative and transactional and the questionable syncretism of different codes: iconic and linguistic ones (auditory and written ones) in the complex textuality of functions of the two.

**Case study 2**

In another maths example of the same site, having to do with the explanation of probability, the visual and auditory presentation of the throw of dice, leading to a number of results graphically presented in a sequence,
poses questions as to simultaneous application of maths operations, to be inferred by the text and to the quickness of audio-visual presentation that should require a longer latency of response.

**Case study 3**

In a different maths demo, math fact fluency demo, proposing auditory and written presentation of real world scenarios, the oral narrative text is matched with a visual animation of the chosen avatar representing the student, entering a math bistro and ordering something. The bill would be the addition of 7+3=10. The pleasant animation does not propose the analytical explanation of the given result, although interactively elicited.

**Case study 4**

In a medicine tutorial, [www.emedsim.com](http://www.emedsim.com), the clear definition of the didactic goal and the audio-visual presentation of the diagnosis procedure is matched with a written presentation and suggested written cues to be combined with a contextual list of written diagnostic options which are not sequential.

As we can see, interact tips are of three types: a wider explanation, a choice of diagnostic options, the invitation to proceed by means of the cue: “continue”. There appears to be a lack of *medicine metalanguage*, the
nomenclature for different signs/symptoms, whose *background knowledge* seems a pre-condition to the choice of the diagnostic choice. Besides, the possible interactive result would be an uncertainty as to which cues to respond in a preliminary way.

**Case study 5**

In an economics demo, the linear auditory-written explanation of the notion of 'goods' is matched with a visual metaphor of a car, which implies a semantic inference of *hyponym*: *car* is included in the *hyperonym* *goods*.

If we apply previous definitions to the analysis of pedagogical implications and evidenced problems in different cases as discussed above, we obtain the following scheme:

*Table 2. Synoptic presentation of textuality problems in e-content multimedia digital texts*

<table>
<thead>
<tr>
<th>audio visual didactic texts</th>
<th>inadequate</th>
<th>too fast</th>
<th>wrong visual implications</th>
<th>language implications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral text</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• narrative</td>
<td>not specific for didactic purposes: -perception -comprehension -functional translation (narrative as different from directive)</td>
<td>not time enough for processing visual and auditory inputs</td>
<td>different linguistic and iconic inferences</td>
<td>lexical dissymmetries between different languages</td>
</tr>
<tr>
<td>Textual-iconic finalization: representative/performative</td>
<td>the textual explanation does not correspond to a conceptual or operative goal</td>
<td>+</td>
<td>flat representation of an oral explanation/error of conceptualization</td>
<td>visual interference</td>
</tr>
<tr>
<td>Required inferences</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• iconic inferences</td>
<td>inferences for the same concept do not coincide/wrong inferences</td>
<td>processing time is not enough</td>
<td>linear cohesion of icons does not correspond to linear cohesion of words</td>
<td>polysemy of icons and words</td>
</tr>
<tr>
<td>Language filters</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>lexical dissymmetries</td>
<td>+ connotation</td>
<td>n.a</td>
<td>language relativism</td>
<td>+</td>
</tr>
</tbody>
</table>

**Conclusions**

The complexity of multimedia-multimodal e-learning content development implies the analysis and integration of a number of didactic communication variables, based on a semiotic-linguistic approach to e-learning digital texts and multimedia textuality.

The identification of problems requires specific solutions to be derived from digital communication theory. These, in turn, should be appreciated in instructional design.

**References**


