DESIGNING LEARNING OBJECTS: A GENRE-BASED APPROACH

Abstract. *In the present paper, a genre-based conceptual framework for interpreting and designing content for learning objects is proposed. Learning objects are considered here as multimodal macrogenres. These macrogenres are constituted of content objects which are in fact types of digital microgenres. The successful and coherent information linking of these content objects inside a LO can be achieved through particular rhetorical relations. The knowledge of the several types of digital microgenres as well as the rhetorical relations between them, can equip an author/ teacher with a repertoire of semiotic concepts, which make him capable of interpreting already made material, as well as creating new and coherent material, in order to affect and motivate students in particular ways, through his intended communicative and educational purposes.*

Key words: *learning objects, content objects, multimodal macrogenres, multimodal microgenres, logico-semantic relations, rhetorical structure theory.*

George Vorvilas, Thanassis Karalis, Konstantinos Ravanis
University of Patras, Greece

George Vorvilas
Thanassis Karalis
Konstantinos Ravanis

Introduction

There are several models for designing educational content for learning objects (LOs). These models are based on the aggregation of learning resources in rational wholes that serve concrete learning objectives. However, they are characterized by heterogeneous views with respect to the determination of the size and the educational functions of LOs: should LOs serve one or more learning objectives? Should they be defined as components of a lesson or should they be equated with the lesson itself, perhaps even with a course or seminar? The definitions of LOs provided by these models are also determined by the wider social and educational purposes that particular communities state in terms of their reuse. Respectively, the aggregation of LOs as well as their reusability varies according to the educational expectations of the organizations/institutions or the teachers who will use them.

Balatsoukas, Morris and O' Brian (2008), have proposed the organization of object-oriented educational content, in three general aggregation levels:

- At the first aggregation level they place digital resources such as raw data (e.g., audio files, text files, video or image fragments etc) and information objects (collections of data with an informative purpose).
- At the second aggregation level, learning objects are created through the combination of raw data as well as information objects. At this level, according to some designers, a learning object can serve more than one learning objective, while others tend to equate it with a lesson.

- Finally, at the third aggregation level, learning objects are aggregated in larger wholes and are used for planning lessons, modules, and courses. Certain designers, however, tend to believe that the term can be equated with a syllabus – or even with a course or a seminar.

Through this heterogeneous spectrum from which the concept of the LOs emerges, the co-dependence between the reusability and educational context of LOs is clearly stated: the bigger the content aggregation, the stronger its dependence on context. Thus, the possibilities for its reusability decrease. The opposite situation appears when we descend to smaller aggregations of content (Wiley, 2002).

In the following paper, a framework for interpreting and designing learning content in the form of LOs is proposed. Vorvilas, Karalis and Ravanis (2010) have outlined a general semiotic approach for interpreting and creating LOs in respect of multimodal discourse analysis (MDA). For MDA, people use particular meanings in order to communicate in specific social contexts. These meanings are created through complex combinations of several modes of communication (e.g. through visual, verbal aural, gestural, three-dimensional and other semiotic resources) (O'Halloran, 2008). MDA examines the ways these combined multimodal resources are integrated and interact in specific social contexts (e.g. classrooms) in order to achieve several communicative functions (see Unsworth, 2006). Vorvilas Karalis and Ravanis (2010) have argued that LOs should be treated as multimodal representations whose content elements generate particular types of meanings. The knowledge of the multimodal meanings that several educational semiotic resources are able to create, can help a teacher to orient the choices of his learning strategies towards a specific educational context (Pantidos, Valakas, Vitoratos & Ravanis, 2008; Pantidos, Valakas, Vitoratos & Ravanis, 2010; Ravanis & Boilevin, 2009).

Methodology of Research

The following sections elaborate a genre-based theoretical framework in order to answer two fundamental questions posited from a MDA perspective:

a) *What types of multimodal digital resources can be detected in an e-learning material (in particular in LOs) and what kinds of communicational goals do they serve?*
b) *How these types of digital resources are linked or can be linked to each other in order to create a coherent e-learning material and serve someone's (author's or teacher's) communicative intentions towards a target group of students?*

In order to answer the first question, the authors of the present paper propose a genre-based interpretation of the elements that constitute LOs. A brief review of contemporary genre theory, in the third section, shows that digital microgenres are the main digital resources through which several communicative goals are expressed in an e-learning material.

In order to answer the second question, the authors propose, in the forth section, a three-level aggregation semiotic model for the information linking between the several resources that constitute LOs. This information linking is interpreted under a theoretical framework adopted from Rhetorical Structure Theory (RST). The latter is an adequate tool for outlining the intentions of an author towards his audience and it is presented here under modifications made by the authors in order to adopt these intentions to educational communicative contexts.

The two theoretical approaches that constitute the proposed conceptual framework (genre theory and RST) are in turn combined in an attempt to illustrate it through an example of a LO borrowed from the field of physics. This particular example was chosen because it offers exemplary combinations of linguistic and pictorial microgenres that facilitate the framework's explanation.

What can be gained from the development and implementation of this theoretical framework is that an author/teacher can be equipped with an adequate vocabulary of concepts that will allow him to interpret the content organization of already made LOs or to create meaningful and cohesive LOs, adequate of being functionally used in specific educational contexts, according to his intended communicative and educational goals.

Content Objects as Multimodal Micro-Genres

Concerning the aforementioned second level of object-oriented content aggregation, the mapping of various information objects proposed by several models is of particular interest. Verbert and Duval (2008) offer such a mapping for nine models of content aggregation (Table 1). They call these information objects "Content Objects" (COs). Many COs result from the partial use of sources adopted from Horn (1998), Ballstaedt (1997) and IEEE LOM (2003).

Without explicitly saying so, many of these content aggregation models make an attempt to organize content for learning through specific generic patterns. Nevertheless, they lack a sufficient account of the communicative goals of their COs as well as an adequate way to describe how these particular communicative goals are coordinated through the content aggregation, in order to serve the LOs' learning objectives. From this perspective, the proposed genre-based approach can help someone (teacher or author/designer) to interpret several content objects as genre types and find the communicative goals they accomplish.

Table 1.   Mapping of Content Object types (ALOCOM Ontology).

Content Object Types		
Next steps	Outline	Illustration
Analogy	Definition	Explanation:
Table	Excursion	Remark
Additional resources	Objective	Overview
Problem statement	Scenario	Summary
Glossary	Principle statement	Introduction
Demonstration	Experiment	Guidance
Motivation	Literature	Reference
Interactivity:	Example	
Simulation	Importance	
Questionnaire	Non-example	
Open question	Paragraph	
Exercise	Prerequisites	
Self-assessment	Review	

Models of reference: SCORM, NETg, Learnativity, NCOM, Cisco, New Economy, SLM, PaKMaS, dLCMS.

Genres are types of communicative events (e.g. written, spoken audiovisual, etc.) which serve concrete communicatiove goals in various social circumstances. These communicative goals are recognized by the members of the wider community in which genres appear and they are achieved through the particular schematic structure of each genre (Swales, 1990). For example, the schematic structure of a market auction is, in general, the following: auctioneer's opening, investigation of object for sale, bidding, and conclusion. More concretely, genres are staged, goal-oriented social processes (Martin, 1999) that allow the organization of social life. These types of communicative events consist of obligatory and optional items that create "beginning, middle, and end" structures. These structures in turn help people to serve their communicative activities, functioning as "'templates' for doing communicative things" (van Leeuwen, 2005, p.128). In Table 2, some types of genres from the field of education are presented.

Many genres can be parts of a bigger collection of semiotic resources. This collection can serve wider communicative goals in comparison with the specific goal which characterizes each one genre solely. In this respect, we can speak of *macrogenres* constituted of several *microgenres* (Martin, 1994). For example, a science textbook is a macrogenre constituted of microgenres such as: reports, procedures, explanations, etc. The authors of the present paper argue that several elementary educational microgenres, like these in Table 2, could be created by educational content designers and tagged with appropriate metadata.

Thus, a teacher could be able to find and use these digital resources, according to their content and their communicative goals, in order to create a particular LO. LOs here are considered as macrogenres, that is as macrostructures constituted of objectives, reports, explanations, glossaries, assessments etc.

Considering the linguistic genres of table 2, in order to achieve their goals, they are usually developed in a sequence of obligatory and optional stages. An argument, for example, can consist of the following stages: Thesis^Argument1-n^ (Recommendation) (^=followed by, () =optional). Similarly, an experiment (a subtype of procedure) has the following structure: Goal^Matterials^Method or Steps^ (Evaluation).

Table 2. Some educational microgenres.

Micro-genre	Communicative goal
Stories	To narrate, record or explain to the student events and circumstances of the human life.
Arguments	To argue for or against on one or more points of view regarding the learning content.
Explanations	To explain to the student how or why a phenomenon happens.
Reports	To classify and describe several types of entities and phenomena in the learning content.
Procedures	To tell the student how to do something.
Learning Objectives	To prepare or orient the student towards the subject matter and to provide him with criteria for successful learning.
Advance organizers	To link student's prior knowledge to the new learning material.
Summaries	To state to the student the basic points ant terms of the subject matter.
Glossaries	To provide the student with brief explanations and definitions of main terms in the subject matter.
Self-assessments	To enable the student to assess the learning process and subject matter understanding
Narrative representations	To represent through image-text combinations several actions, processes and changes.
Classificational representations	To represent through image-text combinations several entities or phenomena through class/ sub-class or co-class relations.
Analytical representations	To represent through image-text combinations several entities in whole/ part relations.

Adopted from: Ballstaedt (1997), Kress & van Leeuwen (2006), Martin & Rose (2008).

Linguistic and pictorial microgenres can be combined in order to create *multimodal microgenres* or *multimodal macrogenres*. For example, a procedure can be presented through a combination of text and still images which clarify the steps someone has to take in order to successfully complete an operation or, alternatively, through a video where a narrator explains these steps performed by a person on the screen.

In the context of the World Wide Web the terms *"digital genres"* or *"cybergenres"* are often used to refer to digital artefacts that serve particular communicative purposes through the hypertextual affordances and capabilities of the internet (Askehave & Nielsen, 2005, Shepherd & Watters, 1998). Digital genres can express themselves through combinations of several semiotic modes (e.g., image, audio, video), thus they are considered to be multimodal artefacts. Furthermore, digital genres in general, compared to traditional printed genres, do not always have a sequential organization, that is, a predetermined staged-like structure which could facilitate a concrete linear reading path someone has to follow. On the contrary, in most cases, it rests with the user himself to create the reading path he wishes through the several components which constitute these genres (Baldry & Thibault, 2006).

Considering the schematic structure of digital genres, it could be said that their genre schema, although non-sequential, can be described in terms of its very typical components and their possible relations. For

example, a web page's genre schema could consist of components like a top banner, a left banner, a top bar, a top centre-right panel, bottom bars, etc (Baldry & Thibault, 2006). These and several other components of web pages (e.g., images, applets, animations, glossaries, application forms, product lists etc) can be also regarded as microgenres, that is elements with specific content and social purposes that constitute larger digital macrogenres (Kudelka, Snasel, Horak, & Abraham, 2009).

Despite the differences between printed and digital genres, a common – to some degree – framework of analysis between them can be established, taking into account that many digital genres do not constitute thoroughly novel artefacts but hybrids, which have adopted characteristics of their traditional predecessors in new social circumstances and have been adapted to the contemporary technological/material basis (Bateman, 2008). The digital macrogenre of homepage, for example, combines traditional elements from promotional/introductory microgenres (e.g., prefaces, introductions, forewords) and newspaper front pages in order to serve specific communicative purposes through the new medium of WWW (Askehave & Nielsen, 2005). In general, it should be more appropriate to discern cybergenres to *extant* and *novel*. The former consist of artefacts based on genres existing in other media, such as paper or video, which have migrated to the new medium of WWW, the latter consist of artefacts that have developed in this new medium and have no real counterpart in another medium (Shepherd & Watters, 1998).

Furthermore, beyond preserving a linear/non-linear dichotomy, someone should bear in mind that hypertext offers two basic modal shifts in the reading process: a "navigating mode" through which the user creates his own reading path in a non-linear way (e.g., through hyperlinks to several sites) and a "reading mode", i.e. the traditional sequential reading process one follows while reading a text (Askehave & Nielsen, 2005).

The adoption of genre theory for the creation of educational content for LOs could contribute to the formation of a conceptual framework for designing and using learning objects in terms of MDA. By adopting this framework, an author/teacher would be equipped with a set of semiotic concepts that allow him to detect in digital repositories several multimodal microgenres, or create them according to his particular educational intentions. For example, if author's intention is to teach a natural phenomenon such as the greenhouse effect, he can create or search for an explanation microgenre. He can link this linguistic microgenre with a suitable token of the "narrative representation" microgenre (Table 2). Linking can be achieved by implementing several logico-semantic relations between text and image (Vorvilas, Karalis & Ravanis, 2010). This new multimodal CO can be combined in turn, through new logico-semantic relations, with several other microgenres-COs, such as learning objectives or an assessment, in order to create a LO. Thus, several educational microgenres could be used as building blocks of LOs content.

The Rhetorical Organization of LOs' Content

After defining COs as digital microgenres, the question of how exactly they are linked to each other as well as with other digital elements in order to create meaningful LOs, must be answered. For this purpose, a three-level content aggregation for LOs' is proposed below (Table 3). At the lower level (Level 1), several semiotic resources called *items,* are placed. These items are phonic, musical, visual and linguistic semiotic resources (Kok, 2004), such as push buttons, submit buttons, radio buttons, checkboxes, captions, bars, icons, symbols, small images, sounds etc. These individual elements can stand alone or they can be combined to each other in order to create COs. Items can be interpreted as *communicative acts*, that is, semiotic resources that help as to do things. Such acts can be speech acts, image acts, sound acts, gestural acts etc, through which people can offer, ask or demand information or goods and services (van Leeuwen, 2005).

COs are placed at the middle level of the scale (Level 2). A CO is an arrangement of communicative acts which serves a particular communicative goal (Table 2). Furthermore, COs can communicate with each other in order to serve a collective purpose inside the LO, for example to accomplish an activity.

Finally at the upper level (Level 3), the LO itself is placed, viewed as a coherent macrogenre consisting of several COs. It could be said that LOs differ from COs in the following respect: while COs can have specific communicative purposes, LOs aim to facilitate at least one learning objective (e.g., to teach a concept, a process, a phenomenon, to accomplish a problem solving or an assessment task, etc). LOs can be several educational macrogenres such as tutorials, simulations, drills and practises, case studies etc.

Table 3.   A three-level scale of interpreting LOs' content aggregation.

Levels of Aggregation	Elements	Example
Level 3	Learning Objects (digital macrogenres)	tutorials, simulations, drills and practices, lessons etc.
Level 2	Content Objects (digital microgenres)	Objectives, assessments, reports, explanations, summaries, representations etc
Level 1	Items (communicative acts)	Buttons, symbols, captions, sounds, boxes, texts, lines etc.

Items and COs can be linked to each other through the logico-semantic relations of *elaborating, extending* and *enhancing*, which can be detected in multimodal texts in general (Lemke, 2002; van Leeuwen, 2005; Djonov, 2006; Kong, 2006; Martin & Rose, 2008). In elaborating, one element (item or microgenre) elaborates the meaning of another one, by describing it in detail, exemplifying it, clarifying or restating it etc. In extending, one element extends the meaning of another one by adding new information, giving an exception to it or offering an alternative. In enhancing, an element expands the meaning of another one by enriching it with new information through circumstantial features of time, place, purpose, cause, condition, manner, means, reason etc.

Complementarily to these relations, Rhetorical Structure Theory (RST) is adopted (Mann and Thomson, 1988) in order to see how items and COs can be linked to each other through particular rhetorical relationships. This theory outlines several rhetorical relationships which can describe the particular intensions of an addresser/author towards an addressee/student, when the former develops learning content (see Tables 3-4). Rhetorical relationships can also be interpreted as subtypes of elaborating, extending and enhancing, as it can be seen in Figure. 1 (see also: Hovy, 1990; Kong, 2006; Matthiessen, 2006; Stuart-Smith, 2007).
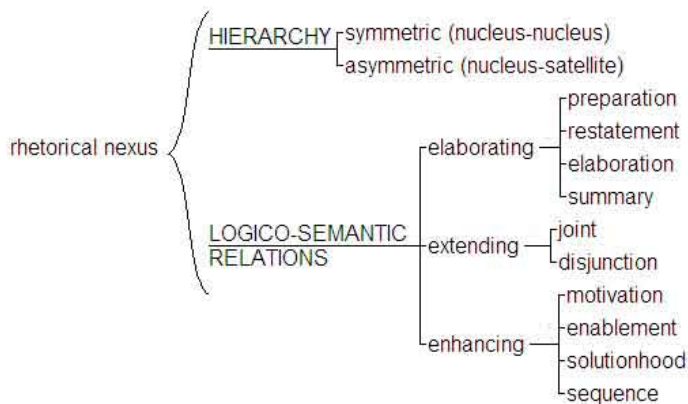

Figure 1:   Some rhetorical relations of LOs' content organization (adopted from Matthiessen, 2006 and Stuart-Smith, 2007).

RST explicates the coherence of multimodal representations, the content of which is organized through symmetric and asymmetric relations among several nuclei and satellite elements. The nucleus is the element (e.g., item, micro-genre, web page etc.) with the most important information, while the satellite is the element which depends on the nucleus. In symmetric relations, the connected elements are of equal importance, functioning independently or complementarily to each other; both of them are considered to be nuclei, thus call these relations are called multinuclear. In asymmetric relations, the elements are of unequal importance: one element (the satellite) depends on another one of greater importance. The asymmetric relations are also called nucleus/satellite relations (see Tables 4-5. *Note*: The relations in tables 4 and 5 have been adopted and modified from the RST web page: http://www.sfu.ca/rst/01intro/definitions.html).

RST was initially used in the field of computational linguistics for text generation, text parsing and mechanic translation (Taboada & Mann, 2006), but in turn it was extended to studies concerning the generation and rhetorical organization of multimedia representations (e.g., André & Rist, 1996; Rocchi & Zancanaro, 2003) and the analysis of multimodal documents (e.g., Bateman, 2008). In the case of multimodal representations and hypertext in general, RST cannot always be applied in a strict manner as it happens in the case of linear text. Nuclearity between several hypertextual elements is not always clear (e.g. which one of them is the nucleus or the satellite) (Bateman, 2008). Additionally, more than one relation between two elements can be detected, or one element can be in several relations with three or more other elements etc. Consequently, the organization of the rhetorical relations in tables 4 and 5 according to the nuclearity principle should not be conceived as rigid as it might seem.

In order to illustrate the proposed conceptual model, an example adopted from the field of Physics is analysed, in particular a LO named "Ohm's Law" (Figures 2-3). This LO is one in a series of four objects (the other three are: "Series and parallel", "Voltage divider", "Light dimmer"). The series is also packaged as a combined LO named "Resistors". This object can be found in the Toolbox repository which is supported by the Australian Flexible Learning Framework (AFLF, 2010) (*Note:* the LO can be found in the address: http://tle.tafevc.com.au/toolbox/access/home.do, by typing "Resistors" in the search form).

Table 4.   Some asymmetric rhetorical relations of content organization.

Relation	Nucleus	Satellite	Author's intention vis-à-vis the student
Elaboration	Basic information	Detailed information with respect to the basic information.	The student recognizes that S provides a detailed content for the already posited information in the N.
Enablement	An action	Information intended to aid the student in performing the action.	To increase the student's potential ability to perform an action regarding N.
Motivation	An action	Information intended to increase the student's desire to perform the action.	To increase the student's desire to perform an action regarding N.
Preparation	Basic information to be presented	Information which prepares the student to expect and interpret the basic information to be presented.	To prepare the student to expect and interpret the information to be presented in N.
Solutionhood	Information supporting full or partial satisfaction of a question, request, problem.	A posited request, question, problem.	The student recognizes N as a solution to the request, question, problem presented in S.
Summary	Basic information	A short restatement of the basic information.	The student recognizes S as a short restatement of N.

Table 5.   Some symmetric rhetorical relations of content organization.

Relation	Nucleus	Nucleus	Author's intention vis-à-vis the student
Disjunction	One alternate information	Other Alternate (inclusive or exclusive) information.	The student comprehends that S offers an alternative, inclusive or exclusive information.
Joint	One information	Another information	The student recognizes that none relation is established between the nuclei. They function independently of each other.
Restatement	Basic information	A re-expression of the information	The student recognizes that one N is a restatement of another N.
Sequence	An information	A next information	The reader recognizes the temporal or causal succession relationships between the nuclei.

At level 1 of content aggregation, "Ohm's Law" consists of several items; some of them are marked by black oval shapes in Figure 2. As previously mentioned, items can operate as communicative acts. In the "Ohm's Law" example, they are static or animated (e.g. The "switch on/off" item) and they offer information (e.g. the buttons "what is current", the caption "Resistance (R)" etc.) or they demand services (e.g. the three sentences in the box on the right side of the page).

At Level 2, several combined items in "Ohm's Law" create COs, that is microgenres. In Figure 2, the three items-sentences in the box on the right side of the page constitute a procedure. In Figure 3, the radio buttons, the text and the submit button ('check') on the same side, constitute a self assessment microgenre. In both Figures, lines, letters and images constitute two more microgenres: an analytical representation (the electric circuit) and a classificational representation (the table). More microgenres inside the LO can be detected: when the student clicks on the "What's current?" or "What's voltage?" buttons he opens two windows which contain two reports respectively. Tokens of the report microgenre can also be found by clicking the "Circuit symbols" button. The microgenres inside the LO co-operate in order to accomplish several activity sequences. For example, in Figure 2 the procedure guides the student to manipulate elements on the animated analytical representation in order to take some numerical results. This co-operation is achieved through particular rhetorical relations between COs, as it will be seen in the following paragraphs.

Finally, at Level 3, the "Ohm's Law" constitutes the final product of the previous two levels and it functions as a section inside a larger combined LO ("Resistors"). It could be said that "Ohm's Law", considered as a macrogenre type, belongs to tutorials.

Considering in turn the rhetorical relations between the contents of the LO, these can be either intra-page or inter-page. An inter-page preparation relation is realized between pages 1 and pages 2-21. Page 1 prepares the student to expect and interpret the basic information to be presented through a learning objective microgenre. Page 1 is the satellite content while pages 2-21 are the nucleus content (Figure 4).

Figure 2: **Items inside a LO.**

Figure 3:   COs inside a LO.

An inter-page summary relation is realized between pages 22-23 and pages 2-21. In pages 22-23 a summary microgenre restates the subject matter which was deployed in pages 2-21. From this perspective, pages 22-23 constitute the satellite content while pages 2-21 constitute the nucleus content (Figure 4).
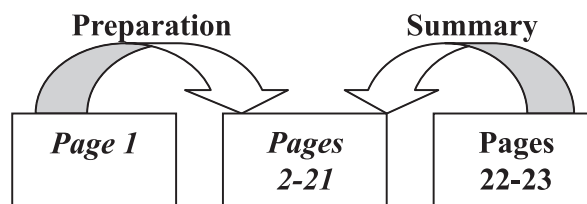

Figure 4:   An example of asymmetric relations.

Two inter-page elaboration relations can be detected by clicking on the items "What's current?" and "What's voltage?" respectively. In each case, a new window opens which provides the student with detailed information through two report micro-genres. The same type of relation is also activated when the user clicks on the "Circuit symbols" button.

A restatement intra-page relation can be detected between the item "Electric circuit" and the animated analytical representation of this circuit. Here the item and the pictorial microgenre function complementarily by expressing the same meaning through different semiotic modes (image and text).

An inter-page joint relation can be detected between the four sections-LOs which constitute "Resistors" content. No relation is established between these sections, thus each one stands autonomous and independent towards the other by offering new information with respect to the subject matter. The sections are in a symmetric hierarchy which is schematically represented in Figure 5.
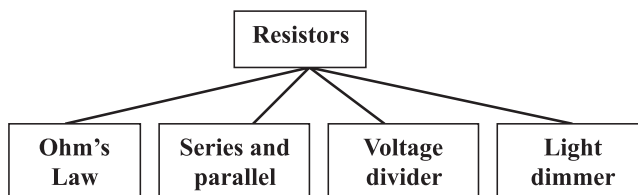
Figure 5: **An example of symmetric relations.**

An intra page disjunction relation is realised through the alternate buttons "View symbols" and "View components". Two different analytical representations of the same circuit can be depicted when the user clicks on these buttons: a *hybrid representation*, where the depicted components are close to the photorealistic code of picturing (as in Figures 2-3), and a *symbolic representation*, where the components are depicted through the symbols which have been adopted for them in the field of Physics (Dimopoulos, Koulaidis & Sklaveniti, 2003). The two representations are alternative ways to represent an electric circuit.

An intra page motivation relation between COs can be seen in Figure 2, where the procedural microgenre on the right side of the page motivates the student through imperatives to interact with the analytical representation and proceed to the next page. Here, the procedure is the satellite CO while the animated image is the nucleus CO. Besides motivation, the relation between the two COs is also an enablement relation: the procedure through its instructions aids the student to interact with the animated representation.

A solutionhood relation is realised when the student presses the "check" button (Figure 3). Solution-hood here has the potentiality to be realized partially, that is through the student's repeated attempts to access the right answer. Finally, a sequence relation between pages is realized by using the "Back" and "Next" buttons throughout the "Ohm's Law" section.

The above analysis does not exhaust all the rhetorical relations someone can find in the aforementioned example. Several other types of relation can be detected; nevertheless, the purpose here was to make clear through an example the basic points of the proposed conceptual model for the meaningful organization of educational material in the form of LOs.

Further Discussion

It should be mentioned that genres do not always display the same degree of consistency. For example, the stages of linguistic microgenres, like these of Table 2, are not so fixed. Always trying to fit a learning material into a "perfectly staged" discourse pattern may be a sterile exercise. Instead of containing a fixed set of obligatory stages, genres rather select and shape their stages and components from a common repertoire of rhetorical patterns (Askehave & Nielsen, 2005). Thus, many genres can share similar components although they serve different communicative goals.

Genres' "fluidity" can be explained in several ways. First of all, the categorizations and distinctions people make between several genres and their subtypes are always dependent on their communicative goals when communities share and use these categories. For example, genres can be categorized, according to people's interests, in terms of their content (e.g., articles, essays), their medium (e.g., written, spoken or electronic), their operation (e.g., informative or persuasive) etc. Secondly, certain members of a human community can recognize and approve the use of a restricted set of these categorizations while others, outside of this particular community, may totally disagree with these categorizations. Consequently, the genre categorizations people make are not always of equal status, they might differ between several groups in a particular society.

Furthermore, even within a particular human community, each adopted genre category is not as stable as it seems. The acceptance of several instances falling under it is not so rigid and may vary considerably. Some of these instances are considered more important for the purposes they carry

out, since they display the maximum number of their category's representative attributes, in contrast with other instances of the same category that share a minimum number of these attributes. Thus, the representative instances operate as prototypes, as "good examples" of the category they belong to, in contrast with other "bad examples" of the same category (Rosch, 1978).

From this point of view, instead of seeking the perfect definition for a genre category according to certain sufficient and necessary attributes, someone could rather speak of "family resemblances" between instances (Wittgenstein, 1999). This means that an instance of a genre category must not necessarily have all the attributes of it in order to belong to it. Rather this instance can share with other instances a maximum or a minimum number of the category's attributes, which permit it to participate in the category's family. The sharable attributes of a genre family that determine the degree of prototypicality for its instances are always dependent on the human community that enacts them and they can change through time. Furthermore, zones of indiscernibility can be found often between genres. As a consequence, an instance of a genre may participate in more than one genre families with respect to the number of representative attributes which shares with them.

The concept of "family resemblances" could also be applied in the case of macrogenres such as LOs. Instead of seeking the perfect definition of what would be a proper LO according to certain sufficient and necessary attributes, someone could rather speaks of family resemblances between instances of educational digital macrogenres that allow someone to recognize them as more or less representative members of a LO's family. In the present example, the "Ohm's Law" belongs to the tutorials' family. As an instance of this family, the LO shares with other members-instances of it some of the representative attributes which constitute the tutorial's schematic structure (Figure 6).
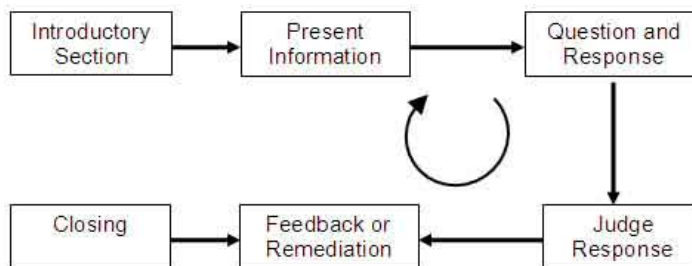

Figure 6:   Tutorial's schematic structure (Alessi & Trollip, 2001, 90).

Nevertheless, this schematic structure should not be conceived as the ideal and perfect prototype to which only imitative instances should be rigidly fall under. Rather the tutorial's schematic structure should be considered as a "diagram" (Deleuze & Guattari, 2000), that is, not as a static form which denotes or represents the LO, but as a dynamic and fluid form which produces it in a space of capabilities, potential variations and material restrictions.

Conclusions

In this paper, an outline of a genre-based framework for interpreting as well as creating content in the form of LOs was proposed. This framework suggests that LOs consist of items and COs. It also suggests that COs can be considered as digital microgenres which serve particular communicative goals inside a LO. Items and COs can be aggregated into meaningful wholes through specific rhetorical relations, with respect to the communicative purposes and intentions someone has towards the students-users. Such a framework could contribute to the creation of a coherent vocabulary which would make an author/teacher of digital educational material aware of the meaning potential of the e-learning materials he uses. In particular, this vocabulary could equip designers of LOs and teachers with extra knowledge about the several types of digital microgenres and their communicative functions, as well as the several types of rhetorical relations that can be detected between combinations

of these microgenres. In this way, in order to make his learning strategies more effective, an author/teacher could be able to create or choose appropriate educational material according to some applicable semiotic guidelines.

References

AFLF, (2010). Australian Flexible Learning Framework. Retrieved 27/2/2011, from: http://www. flexiblelearning.net.au/.

Alessi, S. M., & Trollip, S. P. (2001). *Multimedia for learning: Methods and development*. Boston, MA; Allyn and Bacon.

André, E., & Rist, T. (1996). Coping with temporal constraints in multimedia presentation planning. In *Proceedings of Thirteenth National Conference on Artificial Intelligence* (pp.142-147). Portland, OR: AAAI Press/The MIT Press.

Askehave, I., & Nielsen, A. E. (2005). Digital genres: A challenge to traditional genre theory. *Information Technology & People*, 18(2), 120-141.

Balatsoukas, P., Morris, A., & O'Brien, A. (2008). Learning objects update: Review and critical approach to content aggregation. *Educational Technology & Society*, 11 (2), 119-130.

Baldry, A., & Thibault, P. (2006). *Multimodal transcription and text analysis.* London: Equinox.

Ballstaedt, S. P. (1997). *Wissensvermittlung die gestaltung von lernmaterial*. Weinheim, Beltz PsychologieVerslagsUnion.

Bateman, J. (2008). *Analyzing multimodal documents: A foundation for the systemic analysis of multimodal documents*. London: Palgrave MacMillan.

Deleuze, G., & Guattari, F. (2000). *A Thousand Plateaus.* USA: The University of Minnesota Press.

Dimopoulos, K., Koulaïdis, V., & Sklaveniti, S. (2003). Towards an analysis of visual images in school science textbooks and press articles about science and technology. *Research in Science Education*, 33, 189-216.

Djonov, E. (2006). *Analysing the organisation of information in websites: From hypermedia design to systemic functional hypermedia discourse analysis*. PhD Thesis, School of English and School of Modern Language Studies, University of New South Wales.

Horn, R. E. (1998). Structured writing as a paradigm. Retrieved 27/2/2011, from: http://stanford.edu/~rhorn/a/topic/stwrtng _infomap/artclStrctrdWrtngPrdigm.pdf.

Hovy, E. (1990). Parsimonius and profigate approaches to the question of discource structure relations. In Kathleen, R. Mackeown, Johanna, D. Moore & Sergei Nirenburg (Eds.), *Proceedings of 5th International Workshop on Text Generation* (pp. 59-65). Dawson, Pennsylvania.

IEEE LOM, (2003). WG12: Learning Object Metadata. Retrieved 27/2/2011, from: http://ltsc.ieee.org/ wg12/.

Kok, K. C. (2004). Multisemiotic mediation in hypertext. In K. O'Halloran (Ed.), *Multimodal discourse analysis: Systemic- functional perspectives* (pp. 131-159). London: Continuum.

Kong, K. (2006). A taxonomy of the discourse relations between words and visual. *Information Design Journal*, 14(3), 207-230.

Kress, G., & van Leeuwen, T. (2006). *Reading images: The grammar of visual design*. London: Routledge.

Kudelka, M. Snasel, V., Horak, Z., & Abraham, A. (2009). Social aspects of web page contents. In: A. Ajith, S. Václav & W.-W. Katarzyna (Eds.), *Proceedings of the 2009 International Conference on Computational Aspects of Social Networks* (p.p.80-87). IEEE Computer Society Washington, DC, USA.

Lemke, J. (2002). Travels in hypermodality. *Visual Communication*, 1(3), 299-325.

Mann, W. C., & Thompson, S. A. (1988). Rhetorical Structure Theory: Towards a functional theory of text organization. *Text*, 8, 243-281.

Martin, J. R., & Rose D. (2008). *Genre relations: Mapping culture.* London: Equinox.

Martin, J. R. (1994). Macro-genres: The ecology of the page. *Network*, 21, 29-52.

Martin, J. R. (1999). Modelling context: A crooked path of progress in contextual linguistics (Sydney SFL). In: Ghadessy, M. (Ed.) *Text and context in functional linguistics* (pp. 25-61). Amsterdam: Benjamins.

Matthiessen, C. (2006). The multimodal page: A systematic functional exploration. In: T. Royce & W. Bowcher (Eds.), New directions in the analysis of multimodal discourse (pp. 1-62). USA: Lawrence Erlbaum.

O'Halloran, K. L. (2008). Systemic functional-multimodal discourse analysis (SF-MDA): Constructing ideational meaning using language and visual Imagery'. *Visual Communication,* 7(4), 443-475.

Pantidos, P., Valakas, K., Vitoratos, E., & Ravanis, K. (2008). Towards applied Semiotics: An analysis of iconic gestural signs regarding physics teaching in the light of theatre semiotics. *Semiotica*, 172(1/4), 201-232.

Pantidos, P. Valakas, K. Vitoratos, E. Ravanis, K. (2010). The Materiality of Narrative Spaces: A Theatre Semiotics Perspective into the Teaching of Physics. *Semiotica*, 182(1/4), 305-325.

Ravanis, K., & Boilevin, J. M. (2009). A comparative approach to the representation of light for five-, eight- and ten-year-old children: Educational perspectives. *Journal of Baltic Science Education*, 8(3), 182-190.

Rocchi, C., & Zancanaro, M. (2003). *Generation of video documentaries from discourse structures.* Retrieved 27/2/2011, from: http://peach.itc.it/papers/ewnlg2003.pdf .

Rosch, E. (1978). Principles of categorisation. In: Rosch, E., & Lloyd, B. (Eds), *Cognition and categorisation* (pp.27-47). Hillside, NJ: Lawrence Erlbaum.

Shepherd, M., & Watters, C. R. (1998). The evolution of cybergenres. In: *Proceedings of the Thirty-First Annual Hawaii International Conference on System Sciences (HICSS '98)* (pp. 97-109), Vol. II, Hawaii.

Stuart-Smith, V. (2007). The hierarchical organization of text as conceptualized by Rhetorical Structure Theory: A systemic functional perspective. *Australian Journal of Linguistics*, 27(1), 41-61.

Swales, J. M. (1990). *Genre analysis: English in academic and research settings.* Cambridge: Cambridge University Press.

Taboada, M. & Mann, W. C. (2006). Applications of Rhetorical Structure Theory. *Discourse Studies*, 8 (4), 567-588.

Unsworth, L. (2006). *E-literature for children: Enhancing digital literacy learning.* London & New York: Routledge/Falmer.

van Leeuwen, T. (2005). *Introducing social semiotics.* London & New York: Routledge.

Verbert, K., & Duval, E. (2008). ALOCOM: A generic content model for learning objects. *International Journal on Digital Libraries*, 9(1), 41-63.

Vorvilas, G., Karalis, T., & Ravanis, K. (2010). Applying multimodal discourse analysis to learning objects' user interface. *Contemporary Educational Technology*, 1(3), 255-266.

Wiley, D. A. (2002). *The reusability paradox.* Retrieved 9/9/2009, from: http://rclt.usu.edu/whitepapers/ paradox.html.

Wittgenstein, L. (1999). *Philosophical Investigations.* UK: Blackwell Publishers.

George Vorvilas	Ph.D. Candidate, Department of Educational Sciences and Early Childhood Education, University of Patras, Campus GR-26504, Rio, Achaia, Greece. E-mail: vorvil@upatras.gr
Thanassis Karalis	Assistant Professor, Department of Educational Sciences and Early Childhood Education, University of Patras, Campus GR-26504, Rio, Achaia, Greece. E-mail: karalis@upatras.gr Website: http://www.ecedu.upatras.gr/
Konstantinos Ravanis	Professor, Department of Educational Sciences and Early Childhood Education, University of Patras, Patras, Campus GR-26504, Rio, Achaia, Greece. E-mail: ravanis@upatras.gr Website: http://www.ecedu.upatras.gr/