Multimodal microgenres for designing Learning Objects

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Abstract. This paper presents a genre-based conceptual framework for designing content for learning objects. Some content aggregation models are reviewed in order to stress the lack of such an approach. In this framework, learning objects are considered as multimodal macrogenres. These macrogenres are constituted of content objects which in fact are several types of digital microgenres. The information linking of content objects can be achieved through particular logico-semantic relations between them. Finally, if adopting this framework, an author/teacher is supported by a repertoire of concepts which make him capable of creating coherent material in order to affect and motivate his/her students in particular ways, through his/her intended social and educational purposes.

Keywords: Learning objects; Web genres; Multimodal microgenres; Logico-semantic relations

Introduction

There are several models for designing educational content for learning objects (LOs) which are based on the aggregation of learning resources in rational wholes servicing concrete learning objectives (e.g. ADL, 2006; Löser et al., 2002; Schluep, 2005; Verbert, 2008). Nevertheless, these models are characterized by heterogeneous views with respect to the determination of the size and the educational functions of learning objects: 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 learning objects 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 learning objects as well as their reusability varies according to the educational expectations of the organizations/institutions or the teachers who will use them.

Balatsoukas, Morris & O'Brien (2008) have made a distinction between three general aggregation levels of object-oriented educational content.

1. At the first aggregation level, various small digital items exist, called assets or raw data or media objects (e.g., audio files, text files, video or image fragments, etc., with no learning objective). These media objects – namely information resources, information objects, content objects, etc. – can create larger combinations with no specific learning objective.
2. 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.
3. 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 learning object emerges, the co-dependence between reusability and LOs' educational context 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 sections, a genre-base approach for designing content for learning objects is proposed. Vorvilas, Karalis & Ravanis (2010) and Karalis & Vorvilas (2011) have outlined a general semiotic framework for creating and using LOs and multimedia learning material in general from a multimodal discourse analysis perspective (MDA). For the 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. visual, verbal aural, gestural, three-dimensional etc 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 for example Unsworth (2006)). Learning objects and their content should be treated as multimodal representations which generate particular types of meanings and trigger pedagogical relations of power and involvement. The knowledge of the particular 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 et al., 2008; Ravanis, Koliopoulos & Boilevin, 2008; Ravanis et al., 2011).

Complementary to the aforementioned framework, we adopt here a genre-based approach for the creation of content for LOs. This approach attempts to describe the intended social/educational purposes that several content objects might fulfil as knowledge representation units, and the ways in which an author/teacher can combine them to create LOs, in order to express his motives and purposes towards specific target groups of students. What might be gained from this perspective is that an author/teacher can be equipped with a vocabulary that will allow him to create meaningful and cohesive LOs aimed at being functionally used in specific educational contexts.

Content object types

Concerning the second level of the aforementioned content aggregation, the mapping of the content types proposed by several models is of particular interest. Verbert & Duval (2008) offer such a mapping of nine models of content aggregation (Table 1). Many of these content types result from the partial use of sources adopted from Horn (1998), Ballstaedt (1997) & IEEE LOM (2003).

IEEE LOM is partly used by four models (PaKMaS, dLCMS, Learnativity, and New Economy) and distinguishes various learning resource types such as exercise, simulation, diagram, graph, table, narrative text, experiment, self-assessment, etc. However, it has been argued that this classification confuses the technical characteristics of learning resources (e.g., table, graph, diagram) with the pedagogic use for which they are intended (e.g., exercise, self-assessment, experiment) (Friesen, Roberts & Fisher, 2002). In this respect, Ullrich (2004) has made an effort to provide several instructional functions of learning resources through an ontology that combines elements of Instructional Design Theory and Rhetorical Structure Theory. In a similar effort, Lu & Hsieh (2009) have proposed a relation metadata extension for improving the SCORM Content Aggregation Model which was designed according to IEEE LOM.

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		

Only the dLCMS model uses the classification of Ballstaedt for knowledge representations in educational books and proposes a content organization according to several didactic types. According to Ballstaedt (1997), texts are classified as: expository texts, which describe facts and explain connections between several knowledge domains (e.g., definitions, explanations, arguments); narrative texts, which report events, situations, motives, actions and their consequences; instructional texts, which offer procedural knowledge to the addressee for acting; and supplementary didactic texts, which motivate and support the learning process (e.g., glossaries, self-assessments, advanced organizers, etc.). These text types can also be combined with representations such as images, tables, diagrams etc. While this classification presents an explicit orientation towards a content organization based on text types, it has not become very widely accepted by content aggregation models (Verbert & Duval, 2008).

Rather more popular is the content organization rooted in Horn's Structured Writing (Cisco, PaKMaS, dLCMS, Learnativity, New Economy). Horn (1998) proposed the structuring of content for industrial and business training according to two hundred types of information blocks, such as lists, diagrams, charts, tables, prerequisites, outlines, etc. These information blocks can be staged in particular sequences that create information types. Five information types are most popular and are used in the planning of learning objects: *concepts*, *processes*, *procedures*, *facts* and *principles*. A concept, for example, can be taught through the sequence of several informational blocks: introduction, definition, example, non-example, analogy. Clark (2007) has adopted this model and enriched it with Merrill's Component Display Theory (Merrill, 1994), in order to provide meaningful instructional outcomes. According to Verbert & Duval (2008), single-objective learning objects are commonly classified as kinds of these information types.

A procedure concerns a guided sequence of steps which someone should follow in order to bring to an end a concrete task (e.g., the step by step instructions of treating an injured human limb). A concept concerns a set of ideas, events, symbols and objects, which are connected to each other through fundamental common attributes, but can also be distinguished through secondary individual attributes. A fact provides concrete and unique information based on real conditions, in the form of a statement or a given, concrete object.

Examples of facts are: an Excel balance sheet, a data entry form, the technical characteristics of my printer, etc. A process describes the way in which something functions (e.g., how an enterprise achieves its specific objectives as an entity, how a steel production plant operates etc.). A principle provides guidelines for action that requires critical thinking and the completion of specific tasks in different circumstances. Some examples of principles are: "How do you deal with an aggressive customer?", "How can you improve your communication skills?", "How can you increase the productivity of your department?" etc. (Clark, 2007).

Based on the taxonomies of visuals by Carney & Levin (2002) and Lohr (2003), Clark & Lyons (2004) combined these information types with appropriate visual elements that are helpful in the realization of specific tasks, as much in conventional teaching as in e-learning. The correlation of these information types with concrete social purposes in the field of technical training is of particular interest. For example, procedures are appropriate for training employees in order for them to fulfil specific job tasks determined by the wider strategies implemented by an organization, a company or a factory; principles are appropriate for strengthening the critical thinking of workers with respect to decision-making during critical situations; concepts and facts provide employees with the information they need so as to achieve various tasks (Clark, 2007).

Without explicitly saying so, Horn (1998), Clark (2007) and Ballstaedt (1997) actually make an attempt to organize content for learning through specific communicative patterns. In a similar way, in the field of systemic functional discourse analysis, Martin & Rose (2008) discern a set of genres used in schools and industrial workplaces that service specific social purposes. Martin & Rose offer a genre-based approach to organizing educational content which is adopted in the present paper for the organization of the LOs' content, as it will be explained in the following section.

Educational microgenres

Genres could be defined as sets of communication events which serve concrete communication goals in various social circumstances. These communication goals are recognized by the members of the wider community in which genres appear and 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, 1997) 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 us to serve our communication activities, functioning as "'templates' for doing communicative things" (van Leeuwen, 2005, 128).

Within the context of secondary school, workplace and science based industry, Martin & Rose (2008) detected six main genre families: stories, text responses, arguments, reports, explanations and procedures. Also, within the academic context, Bruce (2008) detected four similar types: reports, recounts, explanations and discussions. These types of genres can be combined with each other and create larger and variant macrostructures. In this respect we can speak of macrogenres (Martin, 1994) constituted of several microgenres. 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 these elementary educational microgenres can be created or detected and used by an author/teacher to create educational content for digital macrogenres, such as learning objects. A brief description of these

microstructures is given in the following paragraphs, according to their elaboration by Martin & Rose (2008).

The social/educational purpose of story genres is to help someone explore several aspects of human life through narration and they can be divided into: 1) *anecdotes* which present the narration of unusual events and people's emotional reaction to them (e.g., "when I went to a football match…"); 2) *exempla* which describe incidents and people's interpretation of them through moral judgment (e.g., interpreting an incident of racist behavior); 3) *observations* through which we comment on and respond to events that affect people (e.g., commenting on an incident of sexual abuse); 4) *narratives*, which express a complication in the narrator's life and its resolution (e.g., a narrative of someone's initial rejection by his community due to racist stereotypes and his subsequent acceptance by that community); 5) *personal recounts*, which record a series of events that constitute a personal experience (e.g., a recount of my holiday in Paris); 6) *biographical recounts*, which record a sequence of events about a person (e.g. a short biography of Einstein); 7) *autobiographical recounts*, which record a sequence of events about myself (e.g., my years at university); 8) *historical recounts*, which record a sequence of episodes and circumstances concerning people and their fate (e.g., the Holocaust); and 9) *historical accounts*, which explain a sequence of episodes and circumstances concerning people and their fate (e.g., social factors that enabled Holocaust).

The social/educational purpose of text responses is to evaluate several texts and they can be divided into: 1) *personal responses*, which express one's feelings about a text (e.g. my emotional positive or negative reaction to a book), 2) *review*s, which summarize selected futures of a visual musical or literary text and evaluate them (e.g. a review of a musician' s new CD), 3) *interpretations*, which illustrate the message of a text (e.g. explaining, evaluating and reaffirming the message of a particular book), and 4) *critical responses*, which challenge the message of a text (e.g. evaluating, deconstructing and challenging the message of a book).

The social/educational purpose of arguments is to argue for or against on one or more points of view and they can be divided into: 1) expositions, which argue for a single position (e.g. an exposition why we should use nuclear energy technologies), 2) discussions, which argue for two or more competing positions (e.g. a discussion for the reasons we should and the reasons we should not use nuclear technologies), and challenges, which set out to demolish an established position (e.g. challenging the use of nuclear technologies in general by offering counter-arguments).

The social/educational purpose of explanations is to explain how or why a phenomenon happens. They are divided into four types: 1) *sequential explanations*, which consist of a sequence of causes and results that are responsible for the appearance of a certain phenomenon (e.g., an explanation of the shaping of DNA in the cellular core); 2) *factorial explanations*, which explain the factors that are responsible for a phenomenon (e.g., an explanation of the factors responsible for water pollution on earth); 3) *consequential explanations*, which explain the consequences of a phenomenon (e.g., an explanation of the consequences of the greenhouse effect); and 4) *conditional explanations*, which explain the necessary relations that exist between various events which, in turn, characterize a phenomenon (e.g., an explanation of the conditions which force an object to float or to sink).

The social/educational purpose of reports is the classification and description of types of phenomena. Reports are divided into three categories: 1) *descriptive reports* which describe the characteristics of a phenomenon (e.g., the description of a whale); 2) *classifying reports* which categorize the members of a general class of concepts or phenomena (e.g., the

classification of minerals); and 3) *compositional reports*, which describe the elements of which an entity is made (e.g., a report on the components of human blood).

The social/educational purpose of procedures is to tell someone how to do something and they are divided into five categories: 1) *experiments*, which are carried out through the use of concrete methods and steps in order for the desired result to be achieved; 2) *operating procedures*, which consist of a sequence of clearly stated steps towards a goal (e.g., a step-by-step process for connecting a PC to a network); 3) *cooperative procedures*, which involve more than one individual for the accomplishing of parallel, step-by-step tasks (e.g., a procedure for dumping a brassert washer); and 4) *conditional procedures*, which require the making of appropriate choices for accomplishing a task, taking into account a set of given conditions (e.g., a process of concrete steps for assessing the damage done to an electric device according to the indications presented by its parts), and 5) *procedural recounts*, which aim, through the use of suitable technical knowledge, at the investigation and recording of technical problems for further treatment. Usually, these take the form of technical notes, experiment/observation reports and research articles.

In order to achieve their purposes, the aforementioned microgenres are developed in a sequence of obligatory and optional stages. An argument, for example, can consists of the following stages: Thesis^Argument1-n^(Recomendation) (^=followed by, ()=optional). Similarly, an experiment has the following structure: Goal^Matterials^Method or Steps^(Evaluation).

Microgenres are not exhausted only in the linguistic types we have already mentioned. We could also consider as microgenres several types of pictorial genres that serve particular communicative goals within the educational content (see for example Clark & Lyons, 2004; Dimopoulos et al., 2003; Kress & van Leeuwen, 2006). In the context of the World Wide Web the terms "digital genres" or "Web genres" are often used to refer to digital artifacts that serve particular communicative purposes through the hypertextual affordances and capabilities of the internet (Giltrow & Stein, 2009; Santini et al., 2010). Web genres can express themselves through combinations of several semiotic modes (e.g., image, audio, video), thus it is appropriate to talk about multimodal Web macrogenres and microgenres. A procedure, for example, 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.

Furthermore, many Web 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 traversal of the components constituting these genres. Take for example the schematic structure of the compositional report. In a traditional and text-dominated printed form, such a microgenre could consist of the following predetermined linear stages: Classification of entity^ Components^ Definition (Martin & Rose, 2008). On the contrary, the cluster depicted in picture 1, which is part of a LO macrogenre, allows the reader many entry points on the screen by clicking on several parts of the animated image, so he can shape his own reading path through the parts of the animal cell (LO1, 2011). Additionally, the reader can also create a linear reading path which is dictated by the alphabetical order of the labels on the right side of the screen.

Considering the schematic structure of Web genres, it could be said that the genre schema of a web page, although non-sequential, can be described in terms of its very typical

components and their possible relations. An example of such a 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 regarded as microgenres, that are elements with specific content and social purposes constituting larger digital macrogenres (Kudelka et al., 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 Web genres do not constitute thoroughly novel artifacts but hybrids, which have adopted and adapted to characteristics of their traditional predecessors in new social circumstances and on a different technological/material basis (Bateman, 2008). The 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 Web (Askehave & Nielsen, 2005). 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). In general, it should be more appropriate to discern Web genres to extant and novel. The former consist of artifacts based on genres existing in other media, such as paper or video, which have migrated to the Web, the latter consist of artifacts that have developed in this new medium and have no real counterpart in another medium (Shepherd & Watters, 1998).

The adoption of genre theory for the creation of educational content for learning objects could contribute to the configuration of a conceptual framework for designing and using learning objects in terms of multimodal discourse analysis. By adopting this framework, an author/teacher will be equipped with a set of semiotic tools that allow him to detect (for example in a repository) or create several microgenres according to his particular educational intentions. For example, if the author's intention is to describe a natural phenomenon such as the greenhouse effect, he can use a sequential explanation. He can also combine this microgenre with a suitable token of the "narrative representations"microgenre, that is images which represent actions and processes (Kress & van Leeuwen, 2006). This combination can be achieved by implementing several logico-semantic or rhetorical relations in content organization (Vorvilas et al. 2011a; 2011b). Furthermore, he can promote pedagogical relations of power and involvement between his content and the students, with regard to the lexicogrammatical and visual elements he uses in his material (Karalis & Vorvilas, 2011). Thus educational microgenres could be used as building blocks of learning object's content organization.

Information linking between learning objects' components

In this section, a three-level content aggregation of LOs' content organization is proposed (Table 2). According to our semantic approach, learning objects consist of three kinds of components: items, content objects and clusters. Items are phonic, musical, visual and linguistic components such as push buttons, submit buttons, radio buttons, checkboxes, captions, titles, phrases, sentences, bars, symbols, sounds etc. (Level 1). Items can be interpreted as communicative acts which offer, ask or demand information or goods and services (Vorvilas et al., 2011a).

Table 2. LOs semantic content aggregation

Aggregation level	Components	Example
Level 3	Learning Objects (macrogenres)	Presentations, simulations, assessments, games etc.
Level 2	Clusters	Larger arrangements of COs and items
	Content objects (sub-clusters that enact microgenres)	Reports, explanations, narrative representations etc.
Level 1	Items (communicative acts)	Bars, buttons, check boxes, words, captions, symbols etc.

These individual components can stand alone but are usually combined with each other in Content Objects (COs), that is microgenres as those we have already mentioned (Level 2). What is more, COs can be stand alone or combined with each other in order to create clusters. The notion of cluster defines a local grouping of components which is nested within a larger grouping. The latter can also be itself a cluster included in a LO. Thus, clusters can help us comprehend how larger-scale groupings of components within a LO (groups of items and COs that serve a composite communicative goal) contain smaller scale groupings (particular COs). According to Baldry & Thibault (2006) a cluster can be considered as a prefabricated structure which frequently enacts genres. From this point of view, several groupings of items can be interpreted as micro-clusters that instantiate recognized genre types. These micro-clusters can be functionally related to each other so as to create larger clusters with composite communicative/rhetorical goals within a LO.

For example, in Figure 1 the micro-cluster consisting of the animated image of a cell and the list of its organelles' names on its right side, instantiates the 'analytical representations' microgenre, that is, images which depict whole/part relations (Kress & van Leeuwen, 2006). This microgenre is part of a larger multimodal cluster displayed in Figure 1, which is also composed of short descriptive reports.

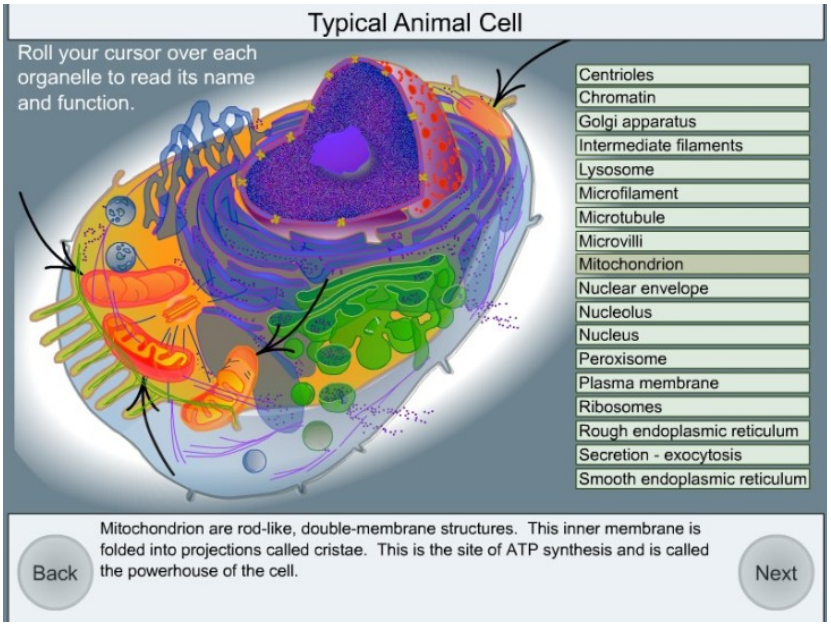

Figure 1. A multimodal genre example

In Figure 2 (LO2, 2011), the text on the left side of the screen instantiates the 'classifying reports' microgenre. The image on the centre of the screen instantiates the 'classicational representations' microgenre, that is images which depict class/sub-class relations (Kress & van Leeuwen 2006). Several other microgenres can be detected when the user clicks on the images' hyperlinks. Those microgenres (enacted by micro-clusters) contribute to the creation of the larger cluster depicted in Figure 2. The composite communicative/educational goal this cluster has within the LO, is to classify/depict the classes of fire as well as to describe several aspects of them. Finally, at the upper level (Level 3), the LO itself is placed, considered as a macrogenre created by several clusters of COs (microgenres). The meaningful information linking between the components mentioned in the three-level content hierarchy, can be achieved through the logico-semantic relations of elaboration, extension, enhancement and projection, which can operate through the deployment of multimodal texts in general (e.g., Lemke, 2002; van Leeuwen, 2005; Djonov, 2006; Kong, 2006; Martin & Rose, 2008).

In elaboration one element elaborates the meaning of another, by describing it in detail, exemplifying, clarifying or restating it etc. In extension, one element extends the meaning of another one by adding new information, giving an exception to it or offering an alternative. In enhancement 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. In projection the meaning of an element appears through another element either as idea or locution. When the second element of relation represents thoughts, projection is mental. When it represents speech, projection is verbal.

An example of information linking between components of a LO is shown in Figure 2. On the centre of the cluster depicted, a classificational image represents the six classes of fires. The image is animated, thus when the user clicks on its items he opens new windows. When the user clicks on the "Class A" item, he opens a new window containing a descriptive report. The relation between the "Class A" item and the opened window is an elaboration: the microgenre in the window describes in detail aspects of this particular class of fires.

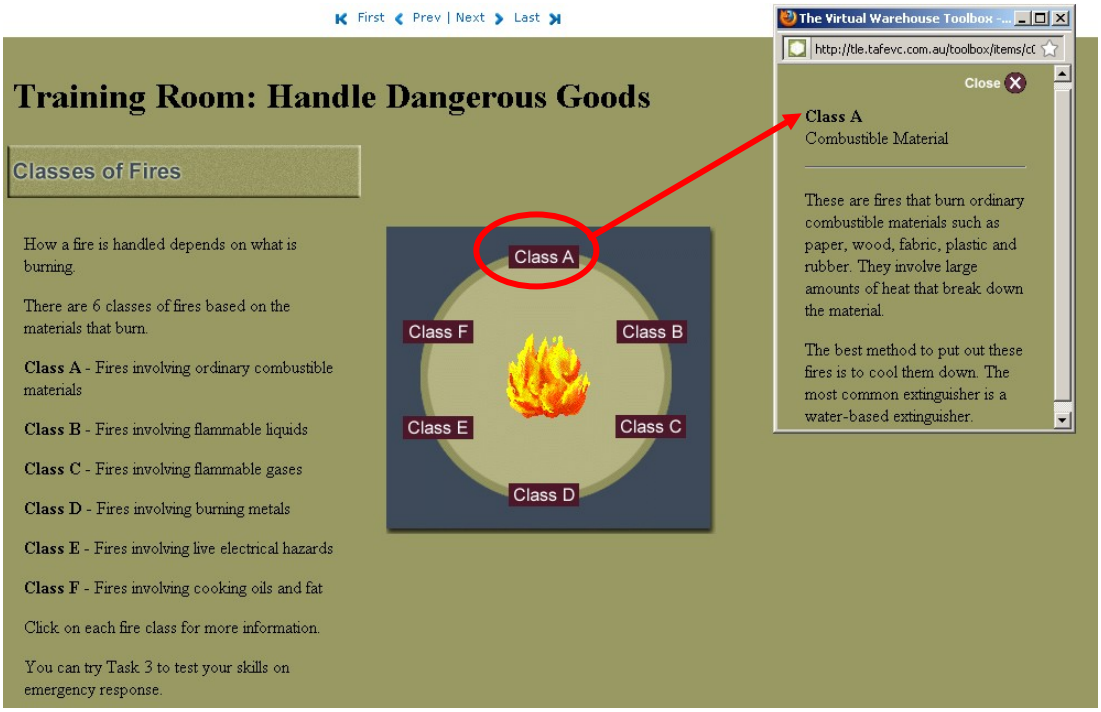

Figure 2. An elaboration relation between components

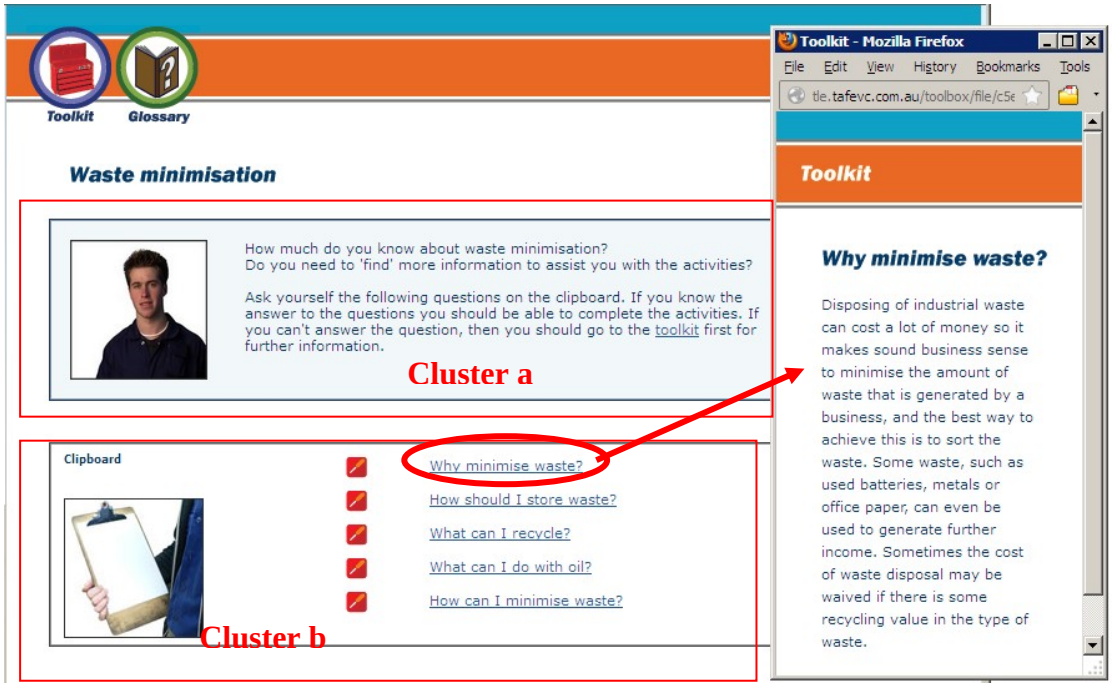

Figure 3. Relations of extension and enhancement between components

An example of the informational linking between components of a LO through the logico-semantic relations of extension and enhancement is shown in Figure 3 (LO3, 2011). The depicted cluster is a sub-unit of a LO named "Waste Minimization". It contains several sub-clusters. Two of them are the sub-clusters a and b. Sub-cluster a contains an instance of the "realistic images" microgenre, that is images which represent entities in a realistic pictorial mode (Dimopoulos et al., 2003). It also contains an instance of the "conditional procedures" microgenre. Sub-cluster b adds new information with respect to sub-cluster a: it poses a set of questions to the user. Thus the two sub-clusters are linked with each other through an extension relation. By clicking on the "Why minimize waste" item in sub-cluster b, the user opens a new window which contains an instance of the "exposition" microgenre arguing about some good reasons for minimizing waste. The relation of this sub-cluster (that is the window with its text) to the "Why minimize waste" item is enhancement: reason.

Figure 4. A projection relation between components

Finally, an example of projection relations between the components of a LO is presented in Figure 4 (LO4, 2011). There, the learner gets the participants opinions by clicking on each one of the depicted human figures. These figures instantiate the "hybrid representations" microgenre, that is, images which represent entities in a semi-realistic pictorial mode (Dimopoulos et al., 2003). The opening windows project the figures' opinions through story microgenres. The relation of each one of these windows to their corresponding images is projection: verbal.

The aforementioned examples show the components of a LO (items, microgenres, clusters/ sub-clusters) can be linked with each other in order to create particular meanings through several reading paths.

Further Discussion

It should be mentioned that genres do not always display the same degree of consistency. For example, the stages of linguistic microgenres, such as those described in the previous sections, are not so fixed. Always trying to fit our learning content 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 components from a common repertoire of rhetorical patterns (Askehave & Nielsen, 2005). Genre "fluidity" can be explained in several ways. First of all, the categorizations and distinctions we make between several genres and their subtypes are always dependent on people's objectives when they are sharing and using these categories. Thus, we can categorize genres according to their content (e.g., articles, essays), their medium (e.g., written, spoken or electronic), and their operation (e.g., informative or persuasive, etc.).

Furthermore, certain members of a human community can recognize and approve only 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 that a community has developed are not always of equal status. The same situation is also applied among the members of each category, where the acceptance of several of its subtypes may differ considerably. Some of them 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 members of the same category that share a minimum number of these attributes. Thus, these representative instances operate as prototypes, as 'good examples' of the category they represent, in contrast with other 'bad examples' of the same category (Rosch, 1978). These attributes that determine the prototypicality of a genre type through the family resemblance between its instances are also always dependent on the human community that enacts them.

The concept of prototypicality could be applied in the case of learning objects as well, considered as macrogenres. Instead of seeking the perfect definition of what would be a proper LO according to certain sufficient and necessary attributes, we could instead speak of 'family resemblances' (Wittgenstein, 1958) between educational Web macrogenres that allow us to categorize them as learning objects.

Conclusions

In this paper, an outline for a genre-based framework for creating content for learning objects was proposed. Precursors of this kind of approach could be considered researchers such as Horn (1998), Clark (2007) and Ballstaedt (1997), whose structuring of learning

materials according to text types or information types has been adopted by several content aggregation models. Content objects that constitute learning objects were conceived as multimodal microgenres with specific social/educational purposes. These content objects can be aggregated into cohesive wholes through specific logico-semantic relations that can be detected or implemented between them.

Such a framework could contribute to the creation of a coherent vocabulary which would make an author/teacher of multimodal educational material aware of the meaning potential of the educational resources he uses or creates. In this respect, the author/teacher will improve its skills in visual literacy by being able to schematize knowledge in educational clusters with communicative/educational purposes.

Our future intention is to transcribe this framework in an adequate metadata schema. This schema could help teachers to describe primary educational resources already available on the Web according to the communicative/educational goals they serve. Teachers could also apply the same metadata schema to describe educational resources that have created themselves. In cases where a teacher wants to combine educational resources of his interest so as to create his own learning material, the metadata schema will provide him with a vocabulary for describing his material's communicative functions.

References

ADL (2006). *SCORM 2004. 3d Edition. Content Aggregation Model (CAM). Version 1.0.* Retrieved 9 September 2009, from http://www.adlnet.org.

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.

Bruce, I. (2008). *Academic writing and genre: A systemic analysis.* London: Continuum.

Carney, R.N., & Levin, J.R. (2002). Pictorial illustrations still improve students' learning from text. *Educational Psychology Review*, 14(1), 5-26.

Clark, R. C. (2007). *Developing technical training: A structured approach for developing classroom and computer-based instructional materials*. San Francisco: Jossey-Bass Pfeiffer.

Clark, R. C. & Lyons C. (2004). *Graphics for learning: Proven guidelines for planning, designing, and evaluating visuals in training materials.* San Francisco: Jossey-Bass Pfeiffer.

Dimopoulos, K., Koulaidis, 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.

Friesen, N., Roberts, A., & Fisher, S. (2002). *CanCore: Learning Object metadata. Canadian Journal of Learning and Technology*, 28. Retrieved 9 September 2009, from http://www.cjlt.ca/index.php/cjlt/article/view/109/102.

Giltrow, J., & Stein, D. (2009). Genres in the Internet: Innovation, evolution and genre theory. In J. Giltrow & D. Stein (eds.), *Genres in the Internet* (p. 1-26). Amsterdam: John Benjanins Publishing Co.

Horn, R.E. (1998). *Structured writing as a paradigm.* Retrieved 9 September 2009, from http://stanford.edu/~rhorn/a/topic/stwrtng_infomap/artclStrctrdWrtngPrdigm.pdf.

IEEE Learning Technology Standards Committee, (2003). *WG12: Learning Object Metadata. IEEE LTSC WG 12.* Retrieved 5 September 2008, from http://ltsc.ieee.org/wg12.

Karalis, T., & Vorvilas, G. (2011). Designing multimedia learning material for adult education: an interdisciplinary approach. *Review of Science, Mathematics and ICT Education*, 5(2), 85-108.

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. *Proceedings of the 2009 International Conference on Computational Aspects of Social Networks* (pp.80-87). Washington, DC: IEEE Computer Society.

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

LO1 (2011). *Typical Animal Cell*. Retrieved 12 December 2011, from http://www.wisc-online.com.

LO2 (2011). *Handle dangerous goods*. Retrieved 12 December 2011, from http://lorn.flexiblelearning.net.au/resultDetail?identifier=42456.

LO3 (2011). *Waste Minimaization*. Retrieved 12December 2011, from http://lorn.flexiblelearning.net.au/resultDetail?identifier=10448.

LO4 (2011). *Support group activities and participate in the work environment*. Retrieved 12 December 2011, from http://lorn.flexiblelearning.net.au/resultDetail?identifier=9892.

Lohr, L. (2003). *Creating graphics for learning and performance: Lessons in visual literacy*. Upper Saddle River, NJ: Merrill Prentice Hall.

Loser, A., Grune, C., & Hoffmann, M. (2002). A didactic model, definition of learning objects and selection of metadata for an online curriculum. In*: Proceedings of the International Workshop of Interactive Computer Aided Learning (ICL), Villach, Austria.* Retrieved 12 December 2011, from http://www.relearn.de/wp-content/uploads/2008/09/losergrune-hoffman_didactic-modell.pdf.

Lu, J.-L., & Hsieh, C-J. (2009). A relation metadata extension for SCORM Content Aggregation Model. *Computer Standards & Interfaces*, 31, 1028-1035.

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

Martin, J. (1997). Analysing genre: functional parameters. In F. Christie & J. Martin (eds.), *Genres and Institutions* (pp. 3-39). NY: Continuum.

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

Merrill, M. D. (1994). *Instructional Design Theory*. New Jersey: Educational Technologiy Publications Inc.

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 theater semiotics. *Semiotica*, 172(1/4), 201-232.

Ravanis, K., Koliopoulos, D., & Boilevin, J.-M. (2008). Construction of a precursor model for the concept of rolling friction in the thought of preschool age children: A socio-cognitive teaching intervention. *Research in Science Education*, 38(4), 421-434.

Ravanis, K., Matalliotaki, E., Vorvilas, G., & Komis, V. (2011). Les «Objets d'Apprentissage» à l'enseignement : quels choix didactiques et épistémologiques?. *Synergies Sud-Est Européen*, 3, 53-62.

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

Santini, M., Mehler, A., & Sharoff, S. (2010). Riding the rough waves of genre on the web. In A. Mehler, S. Sharoff & M. Santini (eds.), *Genres on the Web: computational Models and empirical Studies* (pp. 3-30). New York: Springer.

Schluep, S., (2005). *Modularization and structured markup for web-based learning content in an academic environment.* Ph.D. Thesis, Shaker Verlag, doi:10.3929/ethz-a-005047102.

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

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

Ullrich, C. (2004). Description of an instructional ontology and its application in web services for education. *Proceedings of Workshop on Application of Semantic Web*. Retrieved 9 September 2009, from http://www.carstenullrich.net/pubs/Ullrich-Instructional Ontology-ISWC-2004.pdf.

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. (2008). *An architecture and framework for flexible reuse of learning object components*. PhD. Thesis, Katholieke Universiteit Leuven. Retrieved 10 January 2010, from https://lirias.kuleuven.be/bitstream/123456789/164011/1/PhD.pdf.

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.

Vorvilas, G., Karalis, T., & Ravanis, K. (2011a). Designing Learning Objects: A genre-based approach. *Journal of Baltic Science Education,* 10(2), 114-126.

Vorvilas, G., Karalis, T., & Ravanis, K. (2011b). A Genre-based framework for constructing multimodal content for Learning Objects. *Asian Journal of Computer Science and Information Technology*, 1(1), 1-8.

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

Wittgenstein, L. (1958). *Philosophical Investigations.* UK: Blackwell Publishers.

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