Designing Multimedia Learning Material for Adult Education: An interdisciplinary approach

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Abstract

In the present paper we attempt an interdisciplinary approach on multimedia educational material for adults. We present some hermeneutic tools that help us focus on issues concerning educational material's content structuring, its degree of specialization and learner's guidance, as well as on issues concerning its degree of immediacy and interaction with the learners. Such an interdisciplinary outline could help designers/instructors draw some useful general conclusions.

Keywords

Learning material, knowledge structures, WPW learning model, content specialization, engagement, heteroglossia

Résumé

Dans le présent article nous tentons une approche interdisciplinaire sur le matériel pédagogique multimédia pour les adultes. Nous présentons quelques outils herméneutiques qui nous aident à se concentrer sur les questions concernant la structuration de contenu du matériel pédagogique, son degré de spécialisation et l'orientation des apprenants, ainsi que sur les questions concernant son degré d'immédiateté et l'interaction avec les apprenants. Un tel aperçu interdisciplinaire pourrait aider les concepteurs/formateurs en tirer quelques conclusions générales utiles.

Mots-Clés

Matériel d'apprentissage, structures de connaissances, modèle d'apprentissage WPW, spécialisation du contenu, engagement, hétéroglossie

Introduction

From classic Adult Education scholars to nowadays experts of the filed it is widely recognised that learning in adults is facilitated and enhanced when the instruction is related to adults' prior knowledge and experience (indicatively: Lindeman 1926; Yaxlee, 1929; Knowles 1970). On the other side, active participation in all phases and components of an adult education program seems to be widely recognised as a crucial factor not only for the effectiveness of the program but also for the learners levels of learning and satisfaction (Cross, 1981; Caffarella, 2002; Merriam, Caffarella & Baumgartner, 2007). By the term *phases* we mean here the parts of a program implementation, such as educational needs analysis, planning of the content and evaluation of the educational intervention, while *components* may include learning material (printed, multimedia and e-learning material), learning space and time and teaching methods and techniques (mainly participatory and experiential ones).

In the Greek context, a study conducted in trainees of continuing vocational training showed that the more the trainees participate in the procedures of the training programs they attend, the higher their satisfaction degree is. In other words, the degree of participation of the adult learners in the above mentioned phases of the programs they attend enhances learners' degree of satisfaction (Goulas & Karalis, 2007, p. 33). Deriving from these theoretical underpinnings, but also from empirical findings, *learning material* seems to be a highly considerable factor for planners and educators of adult education programs. Learning material that is designed in order to promote and ensure learners' engagement can contribute to their active participation and increase the effectiveness of educational activities addressed to adults.

Overriding these parameters leads to negative attitudes on behalf of the participants. Adults' learning styles and personal learning pace also have a significant role towards an effective learning process. Asynchronous online learning environments are proved to be an appealing instructional context since they promote learners personal learning pace, self-direction, participation and collaboration. Furthermore, *immediacy* and *interaction* play an important role in online educational environments since they affect the nature and the quality of several forms of communication in e-learning (Pavlis-Korres, Karalis, Leftheriotou & Barriocanal, 2009).

Immediacy concerns the degree of communicative closeness between: a) teacher and student, b) student and student, c) computer and student (LaRose & Whitten, 2000). The

degree of communicative closeness/distance between the above interactions is a decisive factor for promoting or hindering learners' motivation in an on-line environment. Interaction is also a fundamental part of learning experience and according to Moore (1989), it can be discerned to: learner-content, learner-instructor, and learner-learner interactions. Learner-content interaction is the process in which students examine, consider, and process the course information presented during the educational experience. Furthermore, according to Moore and Kearsley (1996), "Every learner has to construct knowledge through a process of personally accommodating information into previously existing cognitive structures. It is interacting with content that results in these changes in the learner's understanding" (p. 128) (Pavlis-Korres et al., o.c., p. 575).

The aforementioned aspects of adult learning entail the drawing of some important general conclusions for the design of multimedia learning material for adults (Pavlis-Kores et al., o.c.; Karalis & Koutsonikos, 2003):

- The content organization must have a clear modular structure and an appropriate graphical design.
- Self-directed and personalized learning should be promoted through content's structure and presentation.
- The content must promote enhancement of the learner's immediacy and interaction with it.

More specifically, researchers in the field of adult education have shown that self-instructional material has some peculiar features which make it prominent in comparison with conventional forms of academic material (Lockwood, 1998): 1) it is oriented to private, individual and self-paced learning, 2) it is available at any time and any place to any number of learners, 3) it is articulated in a standardized, expert and updatable content with explicit aims and objectives and frequent feedback, 4) it promotes structured teaching and individualized tutoring. Additionally, instead of being designed to a wide market, it is oriented to a particular audience and it is structured according to learners' needs. It gives a major emphasis on self assessment and learner evaluation and anticipates potential difficulties. Its language is personal rather than formal, its content is unpacked rather than dense and it requires active response rather than passive reading. Briefly, its orientation is towards a successive teaching rather than a scholarly presentation.

In the following sections we will elaborate some of the above aspects concerning learning material's *organization* and *structuring* as well as aspects concerning learner-content *immediacy* and learner-content *interaction* with the learning material, drawing on theoretical resources mostly from the Cognitive *Theory of Multimedia Learning (CTML)*, the *Systemic Functional Linguistics (SFL)* and the *Multimodal Discourse Analysis (MDA)*. The CTML focuses on the presentation modes of learning materials (e.g. on-

screen text or narration, video or graphics projected, printed text and static images on a textbook etc) and the sensory receptors (e.g. eyes, ears) the learner uses to perceive it, taking into account internal or external barriers posited to his capacity of cognitive processing. The SFL considers language not as a static structure guided by strict grammatical rules but as a dynamic system of meaning potential which enables people making choices from a describable set of options in order to achieve particular communicative goals. The MDA examines the way people create and use particular meanings through complex combinations of several modes of communication (e.g. visual, verbal aural, gestural, three-dimensional semiotic resources etc), in order to communicate in specific social contexts and achieve their goals.

A point of convergence for the aforementioned disciplines is that they investigate the several ways through which words and images represent reality and produce meanings. Highlighting some of their prominent assumptions, can help us design coherent multimedia learning material for adults.

Content Organization and Structuring

Helping the learner to build knowledge structures

According to CTML, active learning can be viewed as a process of structuring and organizing information in order to build an adequate mental model or knowledge structure. A knowledge structure represents the key parts of a learning material and their relationships (Mayer, 2009). Knowledge structures have been elaborated by many authors during the past years, as organizational patterns of discourse which appear with regularity within several forms of text and speech (e.g. Cook and Mayer, 1988; Grimes, 1975; Meyer, 1985). Mayer (2009) presents five main knowledge structures:

- *Processes*. They are knowledge structures which describe a series of events, steps or stages and explain how something works by cause-and-effect chains (e.g. the human heart).They can be represented by flow charts, sequential images etc.
- *Comparisons*. They are knowledge structures which compare/contrast several elements from many aspects and they can be represented as matrices, tables, etc.
- *Generalizations*. They are knowledge structures which represent a main idea with subordinate details (subtopics) which explain, clarify or extent the main topic and they can be represented by branching trees, concept maps, etc.
- *Enumerations*. They are knowledge structures that consist of a collection of items, concepts or elements concerning one or several topics and they can be presented as lists, charts, etc.
- *Classifications*. They are knowledge structures that consist of classes and sub-classes and they can be presented as visual hierarchies of subtopics organized under a class or category (e.g. a graphical classification of sea animals).

Similar to knowledge structures are the *information types* as they have been developed by Horn (1998) and Clark (2007) in the field of Instructional Design (ID) (see also Clark & Lyons, 2004). These are:

- *Concepts.* They are information types which give main information on concrete or abstract concepts by naming them, by describing their attributes, by giving examples and counter-examples of them etc. They can also be represented through diagrams.
- *Facts.* They present measurements, experimental results, associations between things and events etc, through concrete and unique information based on real conditions, although without supporting evidence. (e.g a foreign glossary of biological terms, a list with the technical features of my PC's hardware etc). They can be visualized by lists, tables, matrixes photographs, screen captures, etc.
- *Classifications.* They short chunks/units of a thing/entity into classes and sub-classes which show its different attributes or characteristics. They can be visualized by tables, trees, lists etc.
- *Structures.* They present entities and things with physical or identifiable boundaries which can be divided into parts. They can be visualized through objects' pictures, illustrations or diagrams that depict their boundaries and parts.
- P*rocedures.* They can be sequential or decision-making. Sequential procedures are sequences of steps to be performed in a linear order so as to bring to an end a task or goal. Decision-making procedures concern decisions between bifurcations of alternative sequences of action. They can be visualized by procedure or decision tables, flow charts etc.
- *Processes.* They are explanations of how something operates or takes place. They are usually at a higher level than procedures. While they are frequently business processes (e.g. how an enterprise achieves its specific monthly objectives as an entity, how a factory of steel production operates etc) they can also be chemical, physical, mechanical, electrical, or other (e.g. an explanation of the water circle over the earth etc.). They can be visualized by cause-effect tables, flow charts, process maps etc.
- *Principles.* They are "how to proceed" guidelines aiming at maximizing the chances of a successful problem-solving. They differ from procedures because they lack a fixed sequence of steps and require critical thinking for the completion of specific tasks at specific circumstances (e.g.: "how do you face an aggressive customer?", "how can you increase the productivity of your department? etc"). They can be visualized by diagrams, realistic images relative to the environment in which the problem takes place, etc.

From a SFL perspective, Mohan (1986) has presented six knowledge structures for use

in the English for Specific Purposes (ESP) framework which can also be presented through visualizations (see also: Early, 1990; Early & Tang, 1991; Tang, 1993):

- *Classifications*, which can be used for defining, categorizing and classifying concepts. They can be represented through classification trees or tables.
- *Principles*, which can be used for explaining and predicting cause and effect chains and draw conclusions. They can be represented through circles or tables.
- *Evaluations*, which can be used for evaluating, justifying and criticizing a topic and they can be represented through rating charts, grids and evaluation diagrams.
- *Descriptions*, which can be used for describing, comparing and contrasting concepts and phenomena and they can be represented through pictures, maps and comparison tables.
- *Sequences,* which can be used for describing chronological or logical order and they can be represented through circles, timelines and flow charts.
- *Choices*, which can be used for making decisions or recommending and they are represented through flow charts.

TABLE 1

Types of Knowledge Structures according to CTML, ID and SFL

Mayer (2009)	Horn (1998) & Clark (2007)	Mohan (1986)
Processes	Concepts	Classifications
Comparisons	Classifications	Principles
Generalizations	Structures	Evaluations
Enumerations	Procedures	Descriptions
Classifications	Processes	Sequences
	Principles	Choices
		Facts

In the field of the SFL, *linguistic genres* are used to describe forms of regular discourse patterns (e.g. Martin & Rose, 2008, see Table 2). Nevertheless, knowledge structures differ from linguistic genres in the sense that the latter can be presented through stages in the lexicogrammatical level while the former are semantic in nature (Mohan, 1986). For example, a sequence can be realized through a historical recount's stages (it is a stories' subtype): Background^Chronological Records$_{1\text{-}n}$, or, through a procedure's stages: Goal^Steps$_{1\text{-}n}$^(Results) (^=followed by, ()=optional). Furthermore, descriptions and classifications can be realized through reports, principles through explanations, evaluations through text responses and arguments, choices through conditional procedures (see also Hunter, 2011a). A common aspect of the aforementioned knowledge structures' taxonomies (Table 1), as it has already been

mentioned, is that they can be equally apprehended with the aid of several pictorial genres, (maps, tables, trees, diagrams, pictures etc). The knowledge of the several types of pictorial and linguistic genres that an author of learning material should have at his disposal, can help him to create appropriate content, taking into account the organization of its subject matter according to concrete knowledge structures. In the same vein, Vorvilas, Karalis & Ravanis (2011b) have proposed a conceptual semiotic framework for designing learning objects (LOs), which uses several educational genres as building blocks of multimodal e-learning material.

TABLE 2

Some educational genres

Linguistic genres	Social/ Educational Purpose
Stories	Exploration of several aspects of human life through narration.
Text responses	Evaluation of several texts.
Arguments	Argumentation for or against one or more points of view
Explanations	Explanation of how or why a phenomenon happens.
Reports	Classification and description of types of phenomena.
Procedures	Instruction for doing something.

Creating a coherent content and providing guidance for the learner

Two important implications can be assumed from the use of knowledge structures according to the CTML: "a) the presented material should have a coherent structure, and b) the message should provide guidance for the learner for how to build the structure" (Mayer, 2009, p. 69). Nevertheless, knowledge structures cannot always easily detected by learners due to some hindrances concerning information processing. Several cognitive demands are imposed to the learners' cognitive system during learning, which can overload their cognitive capacity. The CTML detects three types of such demands (Mayer, 2009):

- *Essential processing* which refers to the cognitive processing required for making sense out of the complexity of the essential material (that is, spoken/written words and still/animated images needed to achieve learning objectives). High complexity causes cognitive overload in respect of learners working memory. Thus, essential learning should be managed with several load-reducing methods.
- *Extraneous processing* which refers to the cognitive processing that focus on extraneous material, that is, spoken/written words and still/animated images irrelevant to the learning objectives. Extraneous material results from poor instructional design and it can overload learners working memory with irrelevant

information. Thus we must search for methods for reducing extraneous processing.

- *Generative processing* which refers to the cognitive processing that is caused by the learners motivation to make sense of the presented material. Fostering generative processing through motivation may engage learners in deep learning.

The CTML has proposed some evidence-based principles for reducing extraneous processing, managing essential processing and fostering generative processing when we create multimedia learning material (see table 3, adapted from Mayer, 2010):

TABLE 3

Multimedia principles for effective learning

Principles for reducing extraneous processing
▸ Coherence principle: eliminate extraneous material.
▸ Signalling principle: highlight essential material.
▸ Contiguity principle: place printed words near corresponding graphics.
Principles for managing essential processing
▸ Pre-training principle: provide pre-training in names and characteristics of key concepts.
▸ Segmenting principle: break lessons into learner-controlled segments.
▸ Modality principle: present words in spoken form.
Principles for fostering generative processing
▸ Multimedia principle: present words and pictures rather than words alone.
▸ Personalisation principle: present words in conversational or polite style.
▸ Voice principle: use a human voice rather than a machine voice.

Knowledge structures' comprehension can be facilitated by the aid of visual and verbal clues that guide the learner to create appropriate *reading paths* for meaning-making (see Table 3: signaling principle). Visual clues can be created by highlighting important information through headings, captions, font size, bullets, arrows etc (Mayer, 1999). Verbal clues that signal the presence of a particular knowledge structure can be created with expressions like "first step", "second step" (which signal a sequence or a procedure), or "because", "as a result", "consequently" (which signal a principle or a process) etc.

In the field of Open and Distance Learning such visual and verbal clues are not unknown. Race (1993) mentions *"signposting"* which helps learners know where they are and where they are going in the material. Signposting can be implemented by: a) words that orient the learner in the material, b) flags for activities, prerequisites, objectives etc, c) headings and numbers that denote the manageable content chunking, d) boxes that make key points stand out, e) different kinds and sizes of typefaces or different colors that help learners to discern several content elements (assessments,

activities, glossaries and so on) and finally, f) by the visuals' appropriate size that makes them fitting in the layout without blurring the clarity of content's structure. Additionally, Rowntree (1994) refers to several *access devices* that help learners find their way around a piece of learning material, such as verbal signposts (e.g. phrases that let the learner know where the argument is going) and graphic signals (e.g. bulleted lists, tints and boxes, icons etc). Several other access devices can be placed at the beginning (e.g. menus, site maps, concept maps, advance organizers etc), during (screen headings, section numberings, glossaries, messages, etc), or at the end (e.g. summaries, post-tests etc) of the content's structuring. Generally speaking, access devises scattered throughout the learning material can help learners not only to select and organize information but also to integrate it (see also Mayer, 1999).

According to MDA, reading paths for meaning-making can be created through the arrangement of information in visual structures such as *Given/New*, *Ideal/Real*, *Centre/Margin*, *Salience* as well as through several *framing devices* (Kress & van Leeuwen, 2006; Vorvilas, Karalis & Ravanis, 2010) (framing refers here to the visual composition's layout, not to Bernstein's notion-see below). These structures and devices are responsible for the coherence of the overall visual organization of the material. Content's coherence could also be achieved by implementing a semiotic framework for characterizing the author's intentions towards his audience and explaining how these are implemented in the learning material. Within this framework, irrelevant information to the author's intention could be eliminated (see Table 3: coherence principle). Vorvilas, Karalis & Ravanis (2011a) have proposed the use of Rhetorical Structure Theory (RST) for organizing the coherent information linking between the elements of a learning material according to its author's communicative intentions/goals.

Planning content

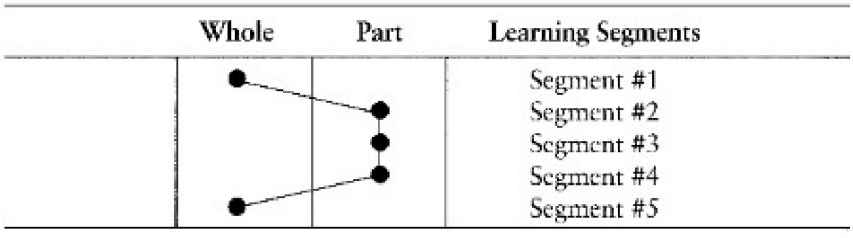
The coherence of a learning material can be influenced by the (in)adequate planning of its content. Content planning can be: a) topic-oriented, b) concept-oriented and c) task- or objective-oriented. These types of content planning can be realized by diagramming the relations between topics and sub-topics, between concepts or between skills and knowledge components, through the use of concept maps or tables (Romiszowksi, 1986). Learners in multimedia environments have more expectations than scrolling paragraphs of text, since meaning paths are deployed in a non linear way. Concepts maps can help an author to make visible the relations between ideas and practices in a knowledge domain and build coherent learning paths (Turner, 2009). Hunter (2011b) has proposed a graphical representation of Mohan's knowledge structures which can be used in combination in order to create the semantic mapping of a text's organization of information. In the same vein and from a MDA approach, Martinec and van Leeuwen

(2009) have proposed the semantic mapping of the conventional linear content through non-linear information structures which can be used from web designers in order to create coherent presentations. These structures are:

- *Given and New*, which divides information in two poles (left and right) that contrast each other with respect to a given and a new information. An example of given information is a learning content's navigation structure which is placed in the left of the screen while the new additional information is presented in the right side of the screen through the hyperlinks of the navigation menu.
- *Ideal and Real*, which divides information in two poles, one ideal which is placed in the top of the screen representing general and idealized information and one real which is placed in the bottom of the screen representing documentary evidence and details.
- *Star*, which has a nucleus element carrying the core information in the centre and other satellite elements arranged in the periphery around it. Satellites are related to the nucleus by attributive or identifying relations. Nucleus is the overall focus of a particular topic.
- *Tree*, which classifies information into hierarchies of "kind of" and "part of" trees.
- *Table*, which is used for the comparison of several parts of information.
- *Network*, which is used for showing the relations between non hierarchical items of information.

An advantageous way for planning the learning material's coherent sequencing, it could be the *Whole-Part-Whole (WPW) Learning Model* (Knowles, Holton & Swanson, 2005). The WPW Model states that there is a natural "whole-part-whole" rhythmic pattern during the learning process. Although this model provides to the instructor a systematic design framework at the level of program and lesson design, it could be equally adopted for creating learning material for adults. The model uses a main learning template through which segments of a learning material could be organized through "first whole" and "second whole" relations (Figure 1).

FIGURE 1



The WPH Learning Model (adopted from Knowles et al., 2005, p. 241)

The "first whole" of the model provides learners' motivation and orientation to the programme/lesson/material (e.g. through clearly stated learning objectives, through prerequisites, through summaries etc) and introduces new content to the learners by providing mental scaffolding (through advance organizers, concept maps etc.). Briefly, the "first whole" prepares the learners for the instructional events to follow. The "second whole", which is characterized as the whole with the major instructional importance, consists of instructional parts that are logically connected in order to be meaningful to the learner (through signposting or several access devices). Nevertheless, when learners follow the instructional sequencing of these parts, they cannot immediately integrate the new knowledge that emanates from them due to cognitive restrictions in their working memory. As a result, learners retain only outstanding features of the parts' sequencing by simplifying large quantities of information. Here, the instructor as well as the learning material should strengthen retrospectively these features by forming the cognitive whole in such a way that the parts of instruction will take a new meaning within it. The acquired new knowledge must in turn be transferred from working memory to long-term memory. This can be achieved by incorporating active learning in the course/lesson as well as in the learning material (e.g. through self-assessments, collaborative activities etc). Active learning reinforces learners' mastery of the learning material's parts so as to integrate new knowledge but also promotes learners' readiness for further understanding (Knowles et al., 2005).

Designating content's degree of specialization

Another aspect of learning material that we should be aware of is its *specialisation*. Specialisation is responsible for the degree of the material's scientificness and objectification with respect to the knowledge domain where it belongs. Higher specialization implies that the learning material has weak links with learner's every-day knowledge and vice versa. A learning material's scientific specialization can be distinguished to: a) *content specialisation* and b) *scientific code's specialisation* (Dimopoulos, Koulaïdis & Sklaveniti, 2003, 2005). The former can be determined under the concept of *classification*, the latter under the concept of *formality*.

Classification refers to the boundaries between scientific and every day knowledge. Strong classification implies discrete boundaries between them whereas weak classification implies their mixing (Bernstein, 1996). As regards language, classification is strong when it provides in a knowledge domain either the solidification of the scientific truth through coherent scientific generalizations or scientifically accurate and systematic taxonomies of entities, concepts and phenomena. Classification is weak when knowledge domain's generalizations are loosely drawn from every-day commonsense knowledge and practices, and when the domain's taxonomies are not

scientific enough but rather tend to behave like folksonomies (Dimopoulos et al., 2005). As regards visuals, classification is strong when concepts, entities and phenomena of a knowledge domain are depicted through codified images, akin to the domain's scientific convections (e.g. histograms, maps, spectrograms, etc), which depict whole/part and class/subclass relations. Classification is weak when images depict these entities, concepts and phenomena of a knowledge domain, in a realistic, close to human perception way, as well as when they depict actions, events and processes taking place in the domain (Dimopoulos et al., 2003).

Formality refers to the degree of abstraction and specialisation that characterize the words and the visuals that constitute the learning material. As regards language, its formality is high when we detect in the content dense use of nominalizations, extensive syntactic complexity, frequent use of terminology and notation relative to the knowledge domain, and finally, extensive use of passive voice which denotes the absence of human agency. Formality is low when active voice, syntactic simplicity and no nominal groups are prevalent and when the relevant to the knowledge domain terminology and notation are infrequent (Dimopoulos et al., 2005). As regards visuals, their formality is high when they are made up of many indexical and symbolic signs (e.g. geometrical shapes and alphanumeric strings) as well as when they are made up of a restricted variety of unmodulated colours (e.g. black and white) on an absent background. Briefly, the more abstract the image, the higher formality it has. Conversely, images' formality is low when they are created with a concrete realistic background over which a broader variety of modulated colours is co-deployed with many iconic signs (e.g. pictures, sketches, paintings etc) (Dimopoulos et al., 2003).

Considering the connection of adults' prior experience and knowledge with the learning material, we could say that when novices are introduced in a new knowledge domain, classification should be weaker and formality should be low or moderate, in order to facilitate learners' knowledge comprehension. As gradually learners become experts in a particular knowledge domain, classification can be stronger and formality can be moderate or higher so as to make learners more acquainted with specialised forms of a scientific knowledge domain (Dimopoulos et al., 2005).

Yet, many experts on adult and distance learning argue that the language of the learning material should be expressed in a personal, informal style. An appropriate informal style can be achieved by using first and second person as well as direct talking to the reader, also by using short paragraphs and short sentences. Race (1993) argues that the use of informal, user-friendly language helps learners to easily learn even on advanced subject material. Low-fliers do not have to waste time to sort out the meaning of a text, since the latter is clearly communicated. Even high-fliers can benefit from an informal language style since they can be acquainted with new meaning rather

faster. Furthermore, friendly language helps learners working alone at ease while their writing style can be significantly improved.

We should bear in mind that when some one designs user-friendly materials, he must avoid the often presented dangerous inclination of producing low specialization content (with weak classification and low formality). Low specialisation leads to the blurring of the boundaries between scientific and every-day knowledge at the expense of the former. Such a blurring can be witnessed in the field of vocational, competency-based training (CBT), where there is often a tendency to undermine knowledge understanding and prioritizing instrumental knowledge based on predictable outcomes. "CBT translates knowledge from being general and principled knowledge to particularised knowledge, because its selection and usefulness is determined by the extent to which it is relevant in a particular context. Students thus have access to knowledge in its particularised form, but are not provided with the means to relate it to its general and principled structure and system of meaning" (Wheelahan, 2010, p. 57).

Promoting self-directed and personalized learning

It is important for adults to have a self-directed and personalized learning. According to the *segmenting principle* of the CTML (Table 3), in order to control a material's complexity it is better to break the material into segments which can be controlled by the learner himself. For example, an animation which explains the water circle might be difficult to be comprehended by a learner unfamiliar with this subject matter when it is presented as a continuous presentation (e.g. it functions as a self activating item-see below). The learner might have not sufficient cognitive capacity to engage in the essential processing for understanding the material and he needs more time to consolidate what is presented. Braking down the material into manageable parts provides the learner with control over his learning pace. This can be achieved in the above example by braking the animation into learner-controlled parts that can be linked to each other through buttons such as "next", "previous", "continue" etc (Mayer, 2009). Thus the animation can be converted to a more interactive item through the affordance of learner-directed timing and pacing.

Bernstein's notion of *framing* can help as elucidate some aspects of guided learning as well. Framing refers to the degree of control that teachers and students exert upon the educational process (Bernstein, 1996). It can be considered as a regulative principle with respect to the rules structuring the learning procedures in a learning context (content selection, sequencing, assessment etc). When framing is strong, control is exerted from the addresser's side (e.g. teacher, educational material, learning object). When framing is weak, control belongs to the addressee (learner, student).

Thus, strong framing indicates that the author's voice explicitly regulates the content, sequencing, pacing and assessment that constitute the learning context. This

could characterize for example a drill and practice application that teaches a procedure. Here learner's options should be deliberately restricted; the control should belong to the procedural, step by step organization of several content elements. The assessment should also, in this case, be strongly framed through questions in the form of true/false, multiple choices, fill in the gap etc. On the contrary, relatively weak framing indicates that the learner has increased and apparent control in respect to sequence, pacing and assessment. This could characterize, for example, a problem solving or a case study application that students are prompted to engage in. In such a context, a large part of the educational control can be given to students whose options are reinforced. Assessment could also be based on open questions, without predetermined answers, whose aim is to promote learners' critical thought rather than guided response.

If our material focuses on knowledge acquisition on behalf of novice learners, then a strong framing can achieve high guidance in a new discipline through a focus on content information and procedural knowledge (e.g. steps of how to create a web site). As gradually learners get more acquitted with new knowledge in the curriculum, their understanding can be extended through a weak framing of the learning material based on a low guidance and an orientation to the critical application of knowledge as well as to the creative skills of the learners. In this case, learners should be reinforced to create their own reading paths and learning trajectories in the learning material, according to their preferences and expectations in respect to the production of concrete learning products (e.g. to create their own web page).

Degrees of framing can be combined according to our learning outcomes when we design learning materials. For example, in the same material the subject matter's framing can be strong while the assessment's framing might be weak, thus providing the learner with more options for critical positioning and negotiating with the learning material.

Promoting Learner's Immediacy and Interaction with the Content

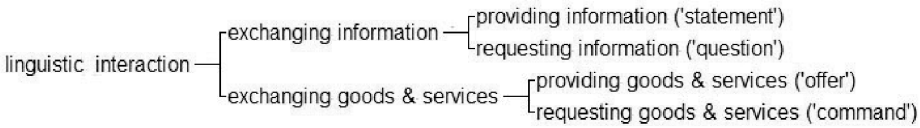
Immediacy and interaction can be promoted or hindered through choices in the language of the learning material as well as through choices in the presentation of the visual elements that constitute it.

Designating the degree of contact and social distance between the learner and the content

Immediacy can be interpreted through the degree of *contact* and *social distance* between the learner and the elements of the learning material. Language uses

communicative acts for accomplishing contact during social interactions, by offering goods and services through offers, demanding goods and services through commands, giving information through statements, demanding information through questions (Figure 2).

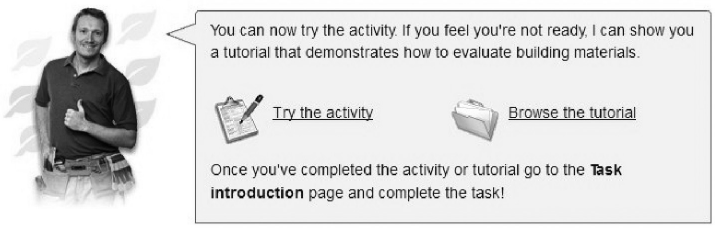
FIGURE 2



Linguistic Interaction (Martinec & van Leeuwen, 2009, p. 3)

In images, contact with the viewer is accomplished through the function of images as 'image acts' which request his attention ("demand-images") or offer to him visual information ("offer-images") (Kress & van Leeuwen, 2006) (see pictures 1 and 2).

PICTURE 1



'Demand-image' accompanied by commands written in social linguistic style (LO 1, 2011)

PICTURE 2

'Offer-image' accompanied by statements written in social linguistic style (LO 2, 2011)

The distance that language creates can be *personal*, *social,* and *public*. Personal style in language is presented through a sparing syntactic structure with many idioms and a dependence on the intimate context of situation in which this language is developed; briefly it can be equated with Bernstein's 'limited code'. Social style corresponds to the daily level of professional and social interactions and requires a standard syntax along with a precise vocabulary due to the social distance between addresser and addressee. Public style requires a clarified and precise adaptation of the message in a context of situation in which an impersonal distance between transmitter and receiver is imposed. It corresponds to Bernstein's 'elaborated code' (Macken-Horarik, 2004).

Images can also create distance which can be categorized as *personal*, *social*, and *impersonal*. At the level of visual display distance is expressed by the` *frame size'* of shots: A close-up expresses an intimate relation between the viewer and the image (e.g. a picture depicting a person's head and face only), a medium shot expresses social distance between them (e.g. the same person portrayed from the waist up), while a long shot expresses an impersonal relation (e.g. torsos of several people with space around them) (Kress & van Leeuwen, 2006).

Designating the pedagogical relationships that shape learner's degree of control and involvement with the content

Learner-content interaction can be interpreted through the pedagogical relationships that shape learner's degree of control and involvement with the learning material. These pedagogic relationships are distinguished in *relations of power* and *relations of involvement*. Dimopoulos et al. (2003) and Dimopoulos et al. (2005) have interpreted them through Bernstein's notion of framing.

As regards language, framing is strong in power relationships when the author takes control of the learning process through imperatives. A moderate framing exists when the learner is supported with some options in answering interrogatives that have been posed by the author, while a weak framing operates through the presence of declaratives which denote a less clear authority of the learning content. In involvement relations, framing is strong when the text denotes in an explicit manner the conditions of learner's involvement through the use of second singular person (you), it is moderate when the text presents a less clear picture of involvement's conditions through the use of first and second plural person (we, you), while it is weak when the text rather focuses on the learning content itself than on the communicating agents, through the use of the third singular or plural person (he, she, it, they) (Dimopoulos et al., 2005).

As regards images, framing is strong in power relationships when image is imposed on the student through the low angle representation of its elements (picture 3c). In moderate framing learner and image have an equal relationship through the eye level

angle representation of the latter (picture 3b), while in weak framing learner imposes over the image through the high angle representation of the latter (picture 3a). In involvement relationships, framing is strong when there is an oblique angle and a medium or distant shot-thus learner's involvement with the image content is minimum-(picture 3a), it is moderate when there is an oblique angle and a close shot or frontal angle and distant shot-thus a moderate involvement with the image content is prompted-(picture 3c), and finally it is weak when there is a frontal angle and a close or medium shot- the learner can involve with the image content in a considerable degree-(picture 3b) (Dimopoulos et al., 2003).

PICTURE 3

	a	b	c
			
Power relationships:	Weak framing (high angle)	Moderate framing (eye level angle)	Strong framing (low angle)
Involvement relationships:	Strong framing (oblique angle & distant shot)	Weak framing (frontal angle & medium shot)	Moderate framing (oblique angle & close shot)
	(a: LO 3, 2011, b: LO 4, 2011, c: LO 5, 2011)		

Framing in power and involvement pedagogical relationships

Promoting heteroglossia

According to the CTML, interaction with the learning material can be motivated when the latter is personalized (see Table 3: personalization principle). Personalization can be realised through a conversational rather than a formal style of language in spoken/written messages (e.g. by using first and second person-'you' and 'I' - rather than third person formulations- 'They', 'he' etc) . Conversational style causes social response on behalf of the learner which commits himself to make out sense of what the speaker says. Consequently, the learner makes a considerable effort to organize and integrate the incoming information which in turn leads to higher quality learning outcomes that better support problem solving transfer. The learner works hard to understand speaker's utterances due to an implicit agreement for conversational cooperation based on Grice's (1975) cooperation principle (Mayer, 2009).

Conversational style can be realized by the use of a *visible-author style* so as to

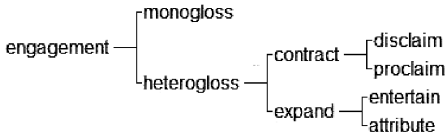
promote learners motivation (Clark & Mayer, 2008; Mayer, 2009). This means that the material is presented in a conversational-dialogical style in which for example the author or other voices are present by stating their position simultaneously through directly or indirectly reported speech. In picture 4 we can see a case in which the learner has access to the information/advices provided by other stuff members of the "E-Tech security" company as well as to several magazines (alternative voices) so as to gather relevant information related to particular tasks.

PICTURE 4

An example of promoting heteroglossia (LO 6, 2011)

How can we create a personalized and many-voices material in order to enhance learner's engagement with it? According to the SFL, whether a text is dialogical or not depends on author's position to other voices. If the author ignores other voices, through a declarative formal style presuming that his readers/learners share with him the same position, then the multimodal text is *monogloss*. If the author acknowledges alternative positions by incorporating other voices, the multimodal text is *heterogloss*. Heteroglossia can be realised through dialogically expansive or dialogically contractive

FIGURE 3



The engagement system (Martin & White, 2005)

formulations (Figure 3). The former concern author's allowance for dialogically alternative positions and voices, the latter concerns author's challenging, fending off or restricting of these voices (Martin & White, 2005).

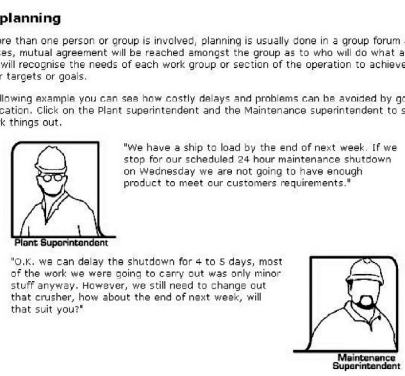
Dialogistic contraction is expressed through grammatical choices that disclaim or proclaim dialogistic alternatives. Disclaiming formulations hold unsustainable, replace or reject an alternative proposition (e.g. 'yet', 'although', 'but', 'never' etc). Proclaiming formulations act rather to limit than directly rejecting the scope of alternative propositions during the ongoing deployment of the text (e.g. 'of course', 'obviously', 'indeed, etc) (Martin & White, 2005).

Dialogistic expansiveness can be expressed by two choices: a) when the author's voice indicates that his position is but one of a number of possible positions, so he makes space in the text by entertaining them. These alternative positions are associated with the text's internal authorial voice (e.g. 'I believe, that…', 'In my view…', 'I think..', 'It may be..', 'It is possible/probable…' etc), b) when the alternative values are dissociated from author's internal voice and are attributed to some external voice presented in the text through directly and indirectly reported speech/ thought (e.g. 'According to Mayer's view…', 'MDA claims that…', 'The report states that…' etc) (Martin & White, 2005).

Dialogistic expansiveness and contraction refer to the grammatical choices for negotiating heteroglossic space. But how can we introduce alternative voices in a text so as to promote heteroglossia? Martin & Rose (2007) identify three types of resources that help as introduce these voices:

- *Projection resources.* Projection may quote or report what someone says (verbal projection) or thoughts (mental projection). Projection resources introduce other voices in the text which expand its heteroglossia by encoding attribution. An

PICTURE 5

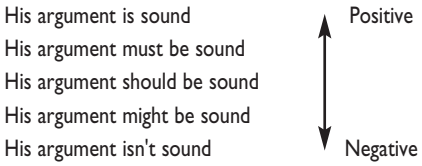


Promoting heteroglossia through projection (LO 7, 2011)

example of verbal projection we can see in picture 5, where the texts in quotation project the conversation between the two depicted persons.

- *Modality resources.* Modality sets up a semantic space between degrees of positivity (yes) and negativity (no) for negotiating information and services. Modality resources introduce other voices either as entertaining an alternative possibility or as attributing alternative propositions to other resources. Modality acknowledges alternative voices around a claim/ topic, thus it opens up a space of negotiation in which several dialogistic alternatives can circulate around an issue, as in the example below (Figure 4):

FIGURE 4



An example of modality's semantic space of negotiation

- *Concession resources.* These are resources for adjusting learners' expectations for alternative voices as the text unfolds. These resources can be concessive conjunctions (e.g. 'of course', 'admittedly', 'however' 'although', 'but', etc.) and continuatives (e.g. 'only', 'just', 'even', 'still', 'finally', etc).

Engagement in a multimedia material can be dealt not only with the resources that provide the authorial voice's dialogic positions in a text and the ways texts negotiate meanings with audiences, but also with the communicative function of several items that constitute a learning material (e.g. pictures, texts, buttons, captions, animations, videos, etc). Tan (2010) following Baldry and Thibault (2006) argues that such items have the potential for dialogic engagement with the viewer and she distinguishes them in: a) *self activating items,* which have an autonomous dynamic function without actively engaging the viewer (e.g. animations, films, sound clips, speech etc), that is, they control the communicative process b) *interactive items,* which react on click and mouse over actions, that is, they delegate to the reader the control of the communicative process, and c) *unresponsive, static or inactive items,* which cannot be influenced by the user (e.g. static pictures, static texts, captions etc), thus they control the communicative process. Tan (2010) considers static or inactive items as instantiations of monoglossia since they present the authorial voice of the material and they do not provide dialogical alternatives and choices for the user. Self activating items are considered dialogically contractive since they close down the space for alternative

choices. Interactive items are considered as dialogically expansive since they position the viewer interpersonally as an active participant in a heteroglossic space and promote alternative choices. The aforementioned analysis does not exhaust the variety of multimodal resources that promote heteroglossia (see also Chen, 2010 for other dialogistic devices in printed textbooks). Its aim was to indicatively describe contemporary trends in the MDA of printed and digital media that can help us design effective multimedia material for adults.

Conclusion

At this paper we presented an interdisciplinary framework that could help us to build coherent and effective multimedia learning material for adults. As it was shown, it is important to help the learner to build knowledge structures (through the use of appropriate images and texts) that will help him to integrate and organize the relevant content information. This can be achieved by implementing the WPW Learning Model in the content sequencing, enhanced with several access devices. The logical succession of the model's content parts can be designed by the use of several types of conceptual mapping. We also saw that immediacy and interaction can be promoted or hindered through choices in the presentation of language and images. A weak framing of the pedagogical relations between content and learners can prompt the latter to be more autonomous and follow alternative learning paths that help them to build critical thought. Yet we must be cautious so as to avoid producing materials poor in quality that may disorient learners from satisfactorily reaching specialised topics of a scientific knowledge domain. Interaction end engagement with the learning material can be promoted by fostering the presence of resources in the learning material that create alternative voices and an expanded heteroglossic space for a specific knowledge domain.

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