

Visual and pedagogical design of eLearning content

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Summary

Context and resources are important dimensions for eLearning programmes. The entire educational endeavour greatly depends on the way in which content is presented, a condition for efficient perceptive-visual learning. Therefore the design of support materials for eLearning is an important element when calibrating the formative value of the educational message.

The present article tries to point out some elements regarding the visual and pedagogical design of learning materials in the digital environment, focusing on content design principles such as page layout, visual arrangements, use of illustrations and colours. In order to develop effective eLearning, the conversion of educational resources into e-content should be carried out following generally agreed rules.

To assimilate and interpret the (mainly) visual content, learners in technology-based environments develop a series of psychological processes such as visual perception, attention, understanding, motivation, memory, thinking and conscience. In order to provide a significant learning situation, effective design must rely on several basic principles aiming to support the participants' confidence and comfort, but mostly their learning performance.

Pedagogical design requires decisions on specific procedures and rules in every step of the process, from the choice of the learning objectives to the choice of the assessment strategies.

The basic visual and pedagogical design ideas presented in this article are meant to constitute a support for further reflection and an invitation to reconsider, expand and empirically validate the theoretical foundation of eLearning, especially concerning a very much evoked and a less clarified issue: how digital resources and new web tools improve the quality of learning.

Keywords: eLearning, web design, visual display, pedagogical design, online education, visual arrangement principles, use of colours, e-content design

1 Introduction and Rationale

ELearning environments differ from one another with respect to some important dimensions: information modality, linearity, type of interaction (human-human, human-machine), number of participants, time (in)dependency, immediacy, place (in)dependency. (Dillemans, 1998, pg. 59) In aiming at better educational environments, improvements in the message embedding modality are most of the time making the difference. On the other hand, limitations caused by poorly designed information modality can have a serious impact on the communication process and therefore on learning performances. The quality of verbal information gained more importance in eLearning; complementarily, non-verbal and para-verbal information have to be substituted with other types of ways to encode, transmit, support and to empower the message: use of illustration and video, use of colours, and visual arrangement.

The particularities of visual perceptive learning in technology-based learning environments emerge from the characteristic of learning materials, which should include all the means that

insure the transfer of knowledge, associated to a specific methodology, since the contact with the course author or with the tutor for further explanations is difficult to achieve. For this reason, the visual perceptive learning is associated to a mostly independent and autonomous knowledge assimilation modality.

Visual perceptive learning is in fact a reading activity (different from traditional reading in the scope for which the text is run over), namely a complex reception of the visual content, mainly text, involving an interpretative understanding. A simple inventory of the psychological processes involved reveals the complexity of reading in order to assimilate and interpret the visual content:

Visual perception - active and specialized for linguistic signs; concentration of *attention*; *understanding* - characteristic of stimuli nature (verbal, in chains, linguistic context integration stimuli, but also implicitly circumstantial); *motivation*, related also to text understanding; *memory* (short and long term); *thinking* - based on an architecture of automatic reflexes (*habits* necessary to the accuracy and rapidity of decoding); *conscience* (as intentionality, than deliberation and control upon actions).

In the teaching-learning experiences, visual communication strategies should be adapted to the learning situation logics to which it applies, and psychological-teaching aspects come first. More efficient than separate transmission is the simultaneous transmission and assimilation of content through the combination of verbal and non-verbal languages, of imagination and verbal structures, of linear and sequential icons with non-linear, instant, global, meaning independent based structures. Distance learning has the almost exclusive merit to combine in the best manner all of these expression channels.

The use of visual perceptive language in learning should aim to achieve the following main objectives, expressed in behavioural terms:

- Acquire pertinent information in respect to its objective;
- Distinguish the informative (referential) elements from the emotional or connotative ones in the message;
- Analyse and capitalize upon expression means that allow to uncover the intention of the message, separating symbolic means from non-symbolic ones;
- Achieve a critical stand in treating the symbolic information received;
- Develop its capacity to select new sources and learning results communication channels;
- Synthesise and integrate received information into personal experiences;
- Recognize the ideology and inner intention of symbolic messages, offered by means of non-specific visual languages expressions, etc.

The degree of convention or coding of icon signs is an important dimension in this respect. Any icon sign, coding result of a perceptive experience, initially requires an “alphabetization” necessary to accurate decoding, since the production and reception of the sign obey certain socially and culturally marked patterns. It is recommended to use a standard code as well as carefully inventoried multi-semantic icons of illustration and indication symbols.

In a certain manner, contemporary distance learning can be compared to early cinematography. The producers of the first motion pictures tended to produce movies as close as possible to theatrical representations - a fix camera was set on the stage. In time, directors have realized that the camera could be moved and that scenes could be filmed from different angles, and time could be manipulated on the montage table.

This comparison applies and can be analyzed at all levels of materials design and eLearning environment planning. “Teachers as film directors” have been exploiting this education channel better each day. New digital technologies and recent research in visual design (visual design, screen design, eye tracking etc.) have expanded significantly the possibilities spectrum and foresee a future that overshadows the “written history” of distance learning.

Unfortunately, due to the newness of computer-assisted learning, on one hand, and due to the complexity of the processes and factors involved, on the other hand, the desirable characteristics of electronic materials for learning are less agreed upon. Thus, the designer of the new learning materials “is working in a less clear domain and must depend even more on a repeated cycle of development, evaluation and revision” (Alessi & Trollip, 2001, pg. 382).

As proven in the last years, the features and major characteristics of the new technologies are only slowly appearing when integrated into education. Beside the theoretical foundations developments, there are a number of factors characterising the conservatism of the education system and which mark the road towards efficient usage: the implementation of hardware and software, the adaptation of the organisational environment, the training of instructional designers, and the introduction of teachers and learners into the system.

2 Towards Effective Design

Even since the early 1970's, research has revealed that communication media plays evidently a less important role in instruction, as compared to the quality of pedagogical design. This observation has determined a re-directioning of practitioners and researchers' attention from the distribution means of learning support materials to designing education curricula and materials in terms of teaching and of education psychology.

A theory is gradually coagulating in support and guidance to education practices oriented towards principle elaboration of effective learning based on printed, audio-video or digital support materials, backed by teacher-student mediated interactions, in conditions of promoting independent studying and distance collaboration. The communication media is reduced to a mere support (not lacking in importance, since it redesigns the teaching-learning process); the development of efficient education situation becomes the highlighted area.

At closer analysis, the comparative research studies published on students learning through new technologies versus traditional education do not concentrate upon the education type comparison (ICT-based or conventional), this being the mere pretext, but on the evaluation of the instructional media design. In distance learning, the design of the support materials acquired important functions, in relationship with the endeavour of calibrating the formative value of the educational message.

3 Design Analysis and Control Premises

Complex domains, instructional design and learning materials design can be approached from multiple angles, any one of the perspectives, evaluated from an integrative theory or praxis level stand point, is a mere constituent of the other perspective. This is the main reason for the following criteria to constitute analysis implicit references:

1. A classroom teaching experience, traditional or modern, mediated or not, can be analyzed throughout two terms: **structure** and **dialogue**. The structure is the extension by which the educator/ the institution is sensible to the needs and desires of the student, whereas dialogue refers to the extension defining the means by which the learner can influence and control the education unit through interaction. Hence, the two terms can become education sequences and materials evaluation referees, as well as guidelines for efficient design. The eLearning design can operationally convert the structure factor into navigation (representation of all designed functions in order to achieve easy access and orientation through the student material), whereas the dialogue factor converts into autonomy level and effective feedback means (indications useful to the educator showing that the program responds to initiatives and that the students' activity was evaluated). In this respect, it is worthwhile emphasize that “the quality of interaction should be the product of the way students cope with instruction, rather than of the technology itself.” (Hoogeveen 1995, *apud* Dillemans)

2. A second perspective is **knowledge organization**. Arranging and structuring content should consider the dialectical unity between **psycho-logics** and **logics**, between knowledge inner organization and their formal structure.

In the means of knowledge representation in the inner structures of the human subject, the following main types can be described: *active representation*, achieved by a conjunction of actions, *iconic representation*, achieved by a conjunction of graphic images that replace notions without defining them, and symbolic representation, carried out by a conjunction of symbolic phrases governed by formation and transformation rules and laws.

3. According to communication functions, the message in a educational material, apart from the dominating **denotative** role governing the juxtaposition and combination of elements, should achieve an additional **connotative** function. The choice of including the receiver in this discourse by means of interrogations, interpellations and imperatives, should be carried out considering the importance of the information unity, its relevance to the learner (in combination with the expressive function), and in respect to the objectives set. The highlight in the support materials design should fall on the manipulation of the tangible/ perceivable side of the message (examining the code used and the best choice, according to the content, between image, sound or text (thus covering the meta-linguistic function of teaching communication)).
4. In analyzing the e-content support design, each element can be regarded in a dynamic **semiotic process**. A sign, as communication action, maintains a solitary relation between the three poles: referee object, signifier and signified (Pierce). The signification depends upon the context of its appearance as well as the expectations of its receiver. The means of meaning generation of the sign, a learning support elements' capacity to create significations and/or interpretations deserve special attention, particularly when learning is achieved almost exclusively upon the visual material and when further explanations are difficult to obtain.
5. **Didactically** speaking, the designing activity carries a gallery of structural elements that can constitute orientating items on the analysis and elaboration of the educational e-content: purpose - participants - learning content - attainment frameworks, rules and principles - methods and means - organization structures - development modes - outcomes - assessment. In this respect, among other aspects, the indissoluble bond between content and teaching-learning methods is remarkable, being achieved in the e-education through thoughtful design.

4 Premises for Pedagogical Design

A possible approach syntax of the teaching and learning content reveals a number of **designing rules**:

- Following simultaneously competences development and knowledge transmission;
- Facilitating independent content structuring actions in an effort of synergistic action of controlled and uncontrolled learning;
- Choose appropriate manners of issues raising in respect to the priority objectives set, in order to assist independent productive thinking;
- Anticipate and organize the development and training of effective thinking strategies;
- Organize content structure so as to vary mental activity levels;
- Create conditions and elements for teaching and learning efficient orientation;
- Create self-control didactical situations.

The main operations guiding the design of education activity can be translated and applied into eLearning programmes by specifying the characteristics required by training specifics. Concisely, these operations are as follows:

- a) Setting the theme, the learner's profile, and the overall time allotted;
- b) Establishing objectives;
- c) Elaborating means of assessment of learner's knowledge and competencies;
- d) Chapter ordering of the content of the material;
- e) Establishing the strategy and the methods of teaching and learning;
- f) Specification and description of study units and auxiliary materials;
- g) Developing the programmes' text, iconic and symbolic plans, or audio-video support;
- h) Programme development or piloting or simulation;
- i) Evaluation;
- j) Programme amelioration.

Furthermore, each of the operations listed are comporting specific procedures and rules of elaboration, starting with decision on the levels of the learning objectives (according to taxonomies of Bloom/ Anderson and Krathwohl on cognitive, affective, psychomotor domains), with decision on the specific assessment methods and instruments, and ending with the selection of the suitable evaluation approach and amelioration procedures.

As far as course development is concerned in text, iconic and symbolic plans, or audio-video support, the analysis criteria (development, evaluation, approval) measure the extent to which:

- Sufficient information and explanation is provided in order for the student to assimilate and apply the study material;
- Information and explanation provided in special units is subjected to control;
- Relaxation moments, attention getters and monotony breakers are anticipated;
- Enabling of horizontal and vertical transfer, as well as discussions initiated by students;
- The agreement between the specific form of the study material and the education objectives;
- Do these serve the teacher as well as the student?
- Does the video material allow a reconstruction of the study material, starting from the objectives or results obtained? (Neacsu, 1990).

5 Text Design Principles

Even if the materials being designed are for multimedia education (on CD-ROM) or web-based education and they include images, sound and even short videos, text continues to play a major part in distance learning. This is why the application of some text organisation principles in the design process will make sense of direction in a page easier and contents can be mentally structured in a proper manner. In this way, the instructional designer can create the conditions for enhancing the capacity for handling the body of knowledge.

Clarity and elegance. An appropriate degree of attention to the text aesthetics and its presentation in a form which is accessible to the reader are the major objectives conferring to a text the attributes of an efficient component of the design of an eLearning material. An elegant aspect and well-ordered and logical arrangement translate the consideration for the learner.

Predictability and regularity. Once established, the structure of a material presentation must remain the same for all course units. In case that a variation in the structure appears, the changes must be justified by instructional needs, but no changes should be made just for the sake of changing things, even if they may be aimed at a better design.

Standardisation and consistency in the use of style. This principle refers to the production of an arrangement which allows a rapid focus without any hesitation on the important elements. The focus shall remain identical for all the sequences of a training material.

Good sense of direction in the content. The length of the section containing the main text or the summary of the content should be relatively short, if possible, so short as to fit the screen (without scrolling). With a rapid loading of relevant information, the user will be able to decide if they want to read, review or abandon the current page.

In addition, in case of digital support, it would be suitable to have customized marking in the contents for the sequences that have been viewed in order to differentiate them from those that are to be assimilated.

In a longer series of screens leading to the content information, a way to indicate the actual position in the structure of the material would be appropriate.

Unity and simplicity. Course authors and the designers of support materials tend to include too many details. It is recommended that a course unit should contain the main ideas and means to access more information on the content. Some research conducted for a comparative analysis of “dense” texts and texts including only the main ideas (by removing 40% of the content of the first ones) resulted in the conclusion that students’ level of achievement stays the same while the duration of the preparation is significantly shorter in the case of the “processed” texts.

Position based on importance. The pieces of information should be positioned in a page in the order of their importance and relevance, the privileged place being the upper left part of the page.

Grouping elements based on their significance. This principle includes a few suggestions for the “topography” of the page. Elements that relate to the same idea should be differentiated from other elements or groups of elements through blank spaces, text boxes or other labelling.

Interpolated indicators. Materials for distance courses need dialogue boxes that indicate student support services such as self-assessment support (themes for reflection, raising issues, optional questions), indicators of other available resources, how tutors can be contacted etc. They should not be abundant in a page, leaving room for the information itself from which they must differentiate clearly through paragraph formats, different fonts, different colours or other design devices. A consistency in the position of these indicators in the visual context facilitates their differentiation.

Including lists and tables to structure the content. A table can resume complex information so as to support learning.

Suggestions for the arrangement of lists are useful for an efficient visual arrangement:

- using “bullets” or indented numbering to mark each item
- vertical arrangement of the lists
- left alignment (- facilitates reading).

Spacing. We recommend that the body of the text occupy from 25 to 40% of the total space of a page. Line spacing should take into consideration the size of the characters and be proportional to it.

Highlighting text units using attributes such as underlined, bold or italic text. A different colour can highlight pieces of information that are considered important. However, exaggeration when using different ways of highlighting a text can lead to a more difficult perception of the message.

Balance and symmetry. Text should have a balanced distribution in a page with graphs and images included. An avalanche of raw information, unprocessed from a visual point of view, is to be avoided as it can impair learning.

6 The Use of Colours

The finding that a varied chromatic range enhances the effectiveness of intellectual activity propelled and diversified research¹ into the influence of colours on the psychic processes involved in the act of learning. The students who study with the help of learning materials provided with chromatic visualisation have better learning achievements than those who use non-chromatic materials. A suitable combination of colours in the learning materials has proved to be as well an important element for developing creativity, memory, intelligence and imagination. Different colours have different effects - some colours facilitate relief from tension and increase concentration, while others have a positive influence on the creation of mental associations, memorizing knowledge, etc.

Colours can be used in a course support at the text level, at the illustration level and for background. The use of colours has mainly a functional justification (as you will see in the following lines), but it determines to a great extent the character and the appearance of materials and implicitly the prestige of the entire eLearning programme.

A. At the text level, if the use of chromatic contrasts is adequate, the precision and the rapidity with which information is perceived and memorised increase by 40-50% compared to simple white-black contrasts. Psychological research into chromatic contrasts has determined the following order, from the highest to the lowest, in the intensity of chromatic contrasts for text from the point of view of their distance legibility and preference in the learning process:

1. black on a yellow background;
2. green on white;
3. red on white;
4. blue on white;
5. white on blue;
6. black on white;
7. yellow on black;
8. white on red;
9. white on green;
10. white on black;
11. red on black;
12. green on red.

When developing learning materials, it is more appropriate to use stronger contrasts for the visualisation of essential knowledge, and less strong contrasts for content information. Anyway, in considering the above suggested chromatic contrasts, adjustments should be made according to the general design idea, using also nuances, tones, and size for a suitable appearance and a professional look. In other words, the science must be combined with art.

B. At the illustration level, the use of colours may increase the significance value of the information presented as iconic representations. The reader receives, processes and interprets a coloured illustration much faster and more efficiently than an illustration in gray tones. Moreover, the symbols which act as visual signals of a particular type of content (questions, self-assessment topics, course objectives, content to be remembered, etc.) are more able to ensure sense of direction if colours are consistently used and with consideration of their conventional meanings (yellow - precaution, red - attention, etc.).

Of course, there are also images that have more effect in gray tones. White-black pictures are often (when they represent actions) more visible, more meaningful and more suggestive, more dramatic than the coloured ones; white-black portraits show better the expression of a person. However, a graph, a histogram, a scheme or a map are better highlighted when colours are used and become more legible and less tiresome. The order of chromatic contrasts in this case

¹ Ever since 1973, the Society for Rational Psychology of Munchen showed that in a stimulating colour environment children's intelligence and creativity increase substantially.

is the following: 1. blue on white; 2. black on yellow; 3. green on white; 4. black on white; 5. green on red.

C. Using different colours for each section and topic can be very useful for a general sense of direction in the learning material. But the most important aspect in the use of background colours refers to their function of influencing behaviour by triggering emotions, intentions, and attitudes.

Here are in short the psychological effects of the main colours which recommend their use in various learning situations:

- *Red*: general stimulator, it provokes, it incites to action, especially at the psychomotor level, an intellectual stimulator, activation, mobilisation, it facilitates associations of ideas. It is specific to the active, autonomous, locomotive, competitive, operative type.
- *Orange*: emotion stimulator, a feeling of closeness, a sociable colour, more active than yellow, it leaves an impression of optimism, joy; when on large areas, it can be irritating.
- *Yellow*: it stimulates and keeps us vigilant, it increases the capacity for mobilization and concentration, it predisposes people to communication; it creates a feeling of warmth and intimacy. It is characteristic of the active, projective, expansive, investigative type with a high level of aspiration. If you look at it for a long time, it can make you feel tired, but when in pale tones, it can be tolerated.
- *Green*: an effect of calm, positive mood, relaxation, meditation, equilibrium, safety; it facilitates relief from tension. It is characteristic of the passive, defensive, autonomous, reluctant type. It expresses concentration, safety, introspection, and self-evaluation.
- *Blue*: it is favourable to the development of inhibition processes and slowing down activity; it urges into calm and reverie, concentration and inner calm, seriousness, meditation. When excessive, it leads to depression. It is characterised by a “depth” of feelings. It is characteristic of the passive, sensitive, perceptive type.
- *Violet*: a stimulating effect, worrying and discouraging; it creates a feeling of seriousness. Its psychological significance is sadness, melancholy, penitence.
- *Black*: psychological effects such as anxiety, reluctance, depression, introversion; an impression of depth, fullness and burden; its psychological significance is sadness, end, loneliness, separation, mourning. It can be used to delimitate, contrast or as a background for other colours.
- *White*: effects of expansion, easiness, grace, robustness, purity, coldness; it expresses peace, acceptance, calm, innocence, cleanliness, austerity.

Obviously, apart from controlling the size of the coloured surface, nuances and tones should be used in order to be suitable with the general layout and to make a discreet fit into the learning situation designed.

An efficient use of colours in the education process has the following influences on learning:

- it increases the quality and efficiency of intellectual work;
- it creates a feeling of psychological comfort, refreshment and good mood;
- it reduces intellectual tiredness and ensures relief from tension;
- it facilitates visual perception, concentration and the memorising ability, it develops imagination and creative thinking;
- it increases the degree of receptiveness, understanding and assimilation of knowledge by the learners;
- it has a positive influence on the learners’ mood.

7 Developing Materials for Web

Some observations on how the Internet users read web pages when carrying out research, looking for current information, obtaining information in their professional area, satisfying their hobbies or simply for entertainment purposes, have lead to some conclusions which are the

norms for efficient design of eLearning materials. These conclusions are relevant to educators when they create text and illustrations for eLearning content - distributed by mail, CDs or on the Internet - and especially for additional support materials.

One of the conclusions formulated by the researchers, that users do not focus their attention on a single website, is relevant - at some point, the distance learner being able to compare two or more different sources of additional information (that means at least three windows open, if we also include the course itself) for a research subject; and if the activity takes place in a collaboration with one or more colleagues, then there will be one or more windows for e-mail or chat room for every participant (synchronised discussion group).

The electronic material containing the course or the pages for additional reading should be in accordance with these characteristics of Internet users taking into account a few logically deduced suggestions:

- The learners can be helped to orientate/ re-orientate themselves by introducing visual organisers:
 - o titles and inter-titles in the page, simple and clear, that allow rapid sense of direction in the content;
 - o significant page titles that help learners recognise the webpage even when it is minimised in the taskbar.
- The designer should start from the premise that an online learning student can't remember the navigation steps leading them to a particular material:
 - o it has been proved that it would be useful to insert an "Ariadne's thread"/ location string in the header to indicate the current position in the sequence or the hierarchical structure of the study material;
 - o keeping standard colours for active links (blue for links that have not been visited and dark red for links that have been visited) facilitates sense of direction, recognition and mental structuring of the content information.
- Using standard terminology eliminates additional time given by a learner to re-correlation and meaning circumscribing when context is rapidly changing.

We should not overlook the fact that the work session of a distance learning student can take several hours, with an alternation of sources, an alternation and variation in working methods and even long interruptions of the activity.

Special attention should be paid to materials for additional reading. All suggestions for improving the degree to which the information content is used should be considered, when the purpose of assimilating knowledge is relatively screened by the label "additional".

It has been ascertained that those who use the Internet frequently do not read web pages word by word. Their eyes scan the text, skim, stopping on some words or sentences. This behaviour is characteristic of approximately 79% of the Internet users, according to the conclusions of a study conducted in 1997 (Nielsen).

In conclusion, the team of course authors and designers should provide text that can be scanned using:

- highlighted key words (bold characters, colour variation, size, distinctive position, in a group of elements clearly separated). A good way to highlight text is to mark significant words as links, and the reader can be sent from these words to explanatory or semantically correlated units of information. The word should appear underlined and in blue in the page - an association of indicators which is relevant to an Internet user.
- significant inter-titles to label content;
- marking lists with symbols (bullets) for every item;
- a single idea in a paragraph. Users overlook any additional idea if it is not contained in the first words of a paragraph.

- the "inverted pyramid" style, in which the first paragraph (named "lead" in the specific literature) succinctly presents the essence of the information; the next paragraphs elaborate on what has been already presented, bringing in complementary information.
- half (or even less) of the number of words used in a conventional/ printed material.

Besides the universal principles presented above, a few other "landmarks" can be added for an efficient webpage design:

a) The designer must discriminate between elements with a funny or purely informative character and elements that can draw attention up to the point of becoming annoying.

- Blinking text and animated images, at some time after having completed the function for which they have been designed - to capture attention -, can disturb and make the user leave the page.
- The entire content of a page must be visible without the user having to adjust the screen horizontally. If the learner has to move to the right to read the whole row and then back to the beginning of the next row, then the instructive activity will be obviously more difficult, if not impossible.

The designer should not overlook the fact that pages where text is complemented by images or short videos - in spite of the advantage of a more pleasant appearance and the fact that the message is more efficiently received - require more space and more time for loading. This is why the images on a page must be optimised not only from a didactic point of view but also by reducing their size. The learner will therefore be able to navigate smoothly from a material to other.

b) Inspiring the learner's confidence in the training material and the education programme. The student should not have doubts about the authenticity of the source and the scientific basis of the content.

- Providing identification information: name of the institution, name of the author granting for the content, valid contact data, the date at which the document was last reviewed.
- Avoiding grammar and typing errors, as well as a thorough checking, with several types of navigation and various versions of these types, on how the parts fit and are aligned in the page. The semantic content of images can produce unintentional effects with inappropriate associations.

c) In web design, one should not overlook the category of learners or audience with low performance systems or who have low speed access to the Internet.

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