Aesthetics and creativity in e-learning material

Matjaž Duh*
Faculty of Education,
University of Maribor,
Koroška cesta 160, 2000 Maribor, Slovenia
Fax: (386) 2-2185-180
E-mail: matjaz.duh@uni-mb.si
*Corresponding author

Marjan Krašna
Faculty of Arts,
University of Maribor,
Koroška cesta 160, 2000 Maribor, Slovenia
E-mail: marjan.krasna@uni-mb.si

Abstract: We do know that new learning material must be interactive and actively involve students in the learning process. The idea is generally good but the implementation sometimes falls behind. During the analysis of e-learning materials that are publicly available, we discovered some noticeable and subtle flaws in the materials.

The contemporary design paradigm of e-learning materials requires products that are didactically useful and aesthetically appropriate. The quality assured development of e-learning materials should be a part of education in all pedagogical studies. Students who study special didactical disciplines should acquire a critical view of the application of e-learning materials through their own prepared presentations.

This article presents a discussion on the aesthetic conditions for designing of e-learning materials. The fundamental parameters for the assessment of aesthetically suitable e-learning materials will be reviewed as well as options for involving students in the learning process.

Keywords: e-learning; aesthetic; education material; design; readability; didactics; legibility; competences.

Reference to this paper should be made as follows: Duh, M. and Krašna, M. (2011) ‘Aesthetics and creativity in e-learning material’, Int. J. Knowledge and Learning, Vol. 7, Nos. 1/2, pp.130–144.

Biographical notes: Matjaž Duh holds a PhD in Art Pedagogy and is an Assistant Professor of Art Pedagogy at the Faculty of Education, University of Maribor. He lectures at the Art Department, Primary School Education Department and the Graduate Program for masters and doctoral studies at the Department for Elementary School Education. For the last few years, he has been actively researching the use of contemporary media in art education, the development of art appreciation, problems of the ongoing paradigm inside art education, the development of artistic expression and other similar works.
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1 Introduction

The ongoing evolution of technology always brings up the question of the evolution of education. Are we ready to replace the teacher with contemporary technology? This question is asked over and over again whenever new technology becomes available. Until now we have found that the answer is still the same and it is negative. Technology, as it is today, is unable to replace the teacher. The artificial intelligence required for a machine to become a teacher will need to be much more advanced than doing intelligent tasks.

Advanced technology can provide tools for better e-learning materials. This statement is often true, but the required effort to produce better e-learning materials is often considerable and as a consequence we still lack high quality e-learning materials. In recent years the situation has improved significantly. E-learning material production should not be regarded as a project but as a programme. From the project management and software engineering project management theory project is something that has start, process and finish, while programme is something that last longer (few years too few decades). The process of designing e-learning materials should address three aspects: technical, didactical-content and aesthetical. The aesthetic requirement is not just for aesthetic pleasure, but also for integrated education, where a high quality of information transfer is required (Duh and Krašna, 2009b). The aesthetic principle is especially important in e-learning where only audio and visual channels are used. In any data transfer, noise is present and this presents a significant problem in education (Tomič, 1999). Transmission noise means that the sent and received data are different. To overcome this problem we need to send redundant data or retransmit the original data. Noise can further be defined as semantic noise, where the message is successfully transmitted but not correctly understood (Fiske, 1990). Noise significantly degrades the learning process and should be taken into account during the process of designing learning materials. Unsuitable typography and low quality multimedia elements (pictures, drawings, photos, audio and video) create semantic noise in the e-learning materials.

From the previous study on the application of computers (see Figure 1) in education we know that the production of e-learning materials is a component of educational networks (Gerlič, 1999). As shown, from the review and analysis of the current available e-learning materials and educational software, it looks like most of them are refined versions of programmed learning units (see Figure 2). Improvements are visible in the mixture of multiple strategies and increased interactivity, which are basically the same programmed e-learning units.
From the constraints implied in the specifications for e-learning material production (Ministry of Education and Sport of Republic of Slovenia, 2010) we found that authors, designers and developers need to follow the curriculum. Verification and validation (V&V) is done by outside reviewers. In theory, the process is proven and it should produce high quality e-learning materials with both content reviews and technical reviews. Two different types of reviews should provide instructions or guidelines on how to improve e-learning materials. Both reviewers should not deviate from their scope and the final product should include their recommendations. But there are situations when two suggestions are mutually exclusive. Such e-learning materials are unable to include both reviewers’ recommendations and it inevitably gets a bad rating from one of the reviewers.
Interactivity is the cause of many misunderstandings (Duh and Krašna, 2009a). We will attempt to define what an interactive element is and what is not in the following section.

2 Semantical noise

E-learning materials use visual and audio stimuli to transmit data. In the design process we need to address different issues to minimise this noise. Therefore, in the design process we need to address: legibility, readability, visual effects and navigation.

2.1 Legibility and readability

It is necessary to use the right typography in e-learning materials. This is not just an aesthetical requirement, it is the technical limitations of the devices that are used to project the computer screen. Typography is a visual language used to record speech or text (Baines, 2002). The role of typography is to effectively transmit written messages (Ruder, 1979). If we know that the first records of communication were visual (images), then we can claim that written words are the graphical representation of language, which evolved from fine art.

Figure 3 Screen fog (see online version for colours)

Typography paints with words; therefore it is an expressive, decorative art capable of manipulating the shape of letters to express much more than just a text (Baines, 2002). Knowledge of the history of typography helps us to select the typography for computer screens in e-learning materials. From the process of the evolution of fonts and the people who created them, we can acquire an enhanced understanding of how to pick the right font for a specific design project during the development of e-learning materials. Designers should know that the primary role of typography is clear communication (Tschichold, 1998). The selection of different font types, the size and colour of the screen can produce visual confusion – screen fog, poor legibility and readability. Extreme cases
of screen fog can be seen on the picture in Figure 3. This should be avoided, yet we see this too often in the classroom.

Legibility is a measure of distinction between signs. Signs should be designed to provide a clear and concise understanding (Jury, 2006). It seems obvious that attention should be paid to the space between words and lines (Ruder, 1979). When the shapes of the signs are easily distinguishable we say that the characters are legible. This applies not just to letters but also to texts. When a text is not legible the reading speed decreases. Reading of such texts requires more effort. It distracts the content and decreases learning efficiency. Most readable fonts have bigger open or closed inner spaces (Jury, 2006). Legibility is also influenced by illumination, background contrast and fatigue of learners.

When we talk about readability we think of recognition of the informative content of a text. The readability of a computer screen depends on the spaces between words and sentences, space between lines and margins. Not so much depends on individual signs or letters. The purpose of readability is so that the reader can extract information carried by letters without too much effort. This applies to texts, tables, footnotes and other screen elements. Even if a computer font is legible it may not be readable at the same time. From this perspective we should know that easy readable fonts are the oldest fonts (like font Caslon) and the least readable are the newer fonts (like font Bodoni) (Berkson, 2010). Today, sans serif fonts have a different appearance and we can hardly talk in general about their readability. From past research, we know that sans serif fonts are less effective for reading; however they are more legible (Jury, 2006). The readability of a computer screen is not just a matter of letters and words but also the complexity of the text, sentence structure and the amount of abstraction in the content described by words. From a didactic perspective we should know the learners and prepare texts according to their comprehension ability.

To specify the distinction between legibility and readability we need to specify their relations. When a text is not very legible it is difficult to read. When a text is difficult to read it does not necessarily mean it is not legible. Line spacing also has side effects. If the line spacing is too big the white-line effect appears. At this point it increases attention and decrease the value of grey colour that is highly important for legibility (Ruder, 1979). Line spacing that is too small makes contact between the letters from the upper and lower lines and has a negative impact on the readers (Lupton, 2004). Therefore, the optimisation of readability is a requirement during the designing of e-learning materials. Good typography helps learners to interpret information. The connection between a text and the visual elements also needs to be addressed. People usually prefer symmetry; however asymmetry sometimes provides rhythm in the functional design (Tschichold, 1998). Asymmetry has the advantage of presenting effective visual images. It includes an aliveness and describes the motion of modern times.

2.2 Visual effects

Computer based e-learning has introduced visual effects into e-learning materials. We can apply these effects in different ways. The least important is the beauty of the visual effects. Visual effects have no function in the transfer of knowledge and are redundant from a didactical viewpoint. Their use is justified in waking up learners when their concentration falls, but they should not be used too often as they are otherwise useless and can easily become a nuisance.
The second type of visual effects is used for the gradual building of a complex visual presentation. With their use we control the complexity level of the content. They have a high didactical value. Teachers know their importance but often make mistakes in sequencing their appearance (i.e., putting the title last, showing something at the wrong time).

Animation is a complex type of visual effect and often requires good technical skills to produce (see Figure 4). It is often used to show the dynamics of systems. When designing animation we also need to consider the length of the animation. Quite often we discover that a long animation confuses learners and they lose the timeline of events. In such events we need to add signs that show the status of the animation (see Figure 5).

Figure 4  Animation (see online version for colours)

Figure 5  Status of animation (see online version for colours)
User feedback indicates that they are in favour of animation and would like more animation since it can express the content more fully and can explain certain principles in a matter of seconds (Vovk Korže et al., 2010).

2.3 Navigation

Another important part of e-learning materials is navigation. It prevents users from becoming lost in the materials. Researchers have shown that the best learning materials (with high retention levels of transferred knowledge) are made sequentially. Such learning material is not suitable for research education and does not allow different paths to proceed to higher levels. From computer games we know that games which provide different ways of completing levels are more attractive than those that allow only one. This opens the discussion about the purpose of e-learning materials:

- e-learning materials that replace classic learning materials
- e-learning materials as an addition to classic learning materials.

In the first case we need to define the path, but in the second case we need to prepare different alternatives and omit some other paths.

Our learning materials for primary school were prepared as an addition to the traditional learning method. We have defined the structure and have hidden some ‘candies’ into some of the modules. With these additional ‘candies’ we tried to encourage students to research the e-learning materials. Such learning materials are not suitable for self-learning since knowledge retention is low, but if teachers are actively involved and encourage the research they are much more effective.

For secondary schools we address a different type of learning, i.e., active involvement.

3 Knowledge and competences

In modern upbringing and education the term competences are frequently used (http://www.europarl.europa.eu). Various explanations of what the term actually means have given rise to certain misunderstandings. In the area of pedagogy, the term competence has more than one meaning. From a pedagogical point of view it is thus necessary to look for a multidisciplinary definition. We can talk about school competences, principal or teacher competences or student/pupil competences. With the latter we can identify certain competences, regardless of terminology differences, that are the result of a complete personality development comprising cognitive, emotional and psycho-motoric levels.

From the point of view of the teacher, we can define a theoretical construct of competences and use it as a hypothetical psychological process that includes cognitive, emotional, motivational, social and behavioural components that teachers obtain to a certain extent through the learning process. Generally speaking, a competence “includes a complex system that is a combination of knowledge and abilities, but also strategy and routine, necessary for the use of knowledge and abilities in addition to certain emotions and points of view and efficient self-regulation of such competences” (Pušnik, 2005).
Regardless of the different interpretations of the required competences, we can summarise some features of generic and subject-specific competences that are independent of a teacher’s experience or level of education. Let us name some of the subject-specific competences: being familiar with the curriculum, good expert knowledge of the subject, teaching, being familiar with the content of teaching, knowledge of a particular subject, being acquainted with a subject’s content and methodology. According to Tuning Educational Structures in Europe (TESE-II) (Gonzales and Wagenaar, 2005) we can define competences as a combination of knowledge, understanding, skills, capabilities and values. Competences are also expressed as the use of one’s knowledge, capability of judgement, grasp of communication skills and skills which they require for further learning. In different subjects of the study curriculum students gradually gain their competences. They are expected to develop a wide array of generic and subject-specific competences which will guarantee success in their future work as teachers. Teachers that are pedagogically competent are expected to integrate their professional (pedagogical) knowledge with their skills and capabilities. Possessing personal characteristics such as empathy, creativity, cooperativeness, ethics, etc., they become a positive role model for their pupils to identify with (Ljubetić et al., 2007). Competent teachers thus become an authority who their pupils can follow. They should not merely use the expert knowledge produced by others, but rather produce such knowledge themselves. Teachers are facing new tasks that require additional training so as to develop a reflective approach to their teaching (Oonk, 2004). EU documents also strongly emphasise lifelong learning as one of the development priorities (European Commission, 2002). “Thus, we expect that teachers possess an interdisciplinary academic education as well as the necessary qualifications to creatively engage in complex problems in education and schooling processes”, (Duh et al., 2009).

4 Mouse clicking generation

One of the competences acquired by students (future teachers) is also digital competence. We can say that digital competences coincide with ICT competences. For teachers, this means knowing and applying ICT directly in pedagogical work. Teachers need to understand contemporary e-learning materials to effectively use them in the educational process and they can actively participate in the development process.

The technical requirements of e-learning materials specify that each screen should have at least two interactive elements and one multimedia element according to its content. The requirements about the audio and video elements on the screens are also defined. It is mandatory to have audio-video elements lasting ten seconds for every five screens and audio-video elements lasting 20 seconds for every ten screens (Ministry of Education and Sport of Republic of Slovenia, 2010).

Interactive elements are defined as markings, selections, movement, grouping, providing feedback and testing the answers. Multimedia elements are defined as sound, picture, video and animation (Ministry of Education and Sport of Republic of Slovenia, 2010).

Each multimedia element must be related to the content of e-learning materials. In most cases a customer only specifies the technical requirements and omits the creative and/or aesthetical aspect of e-learning materials, despite it being known to significantly increase the quality of the e-learning materials (Ministry of Education and Sport of
Republic of Slovenia, 2010). Analysing the texts of the customer’s public tenders (Ministry of Education and Sport of Republic of Slovenia), we can see that they focus entirely on the content and technical aspects (Ministry of Education and Sport of Republic of Slovenia, 2010). Those requirements are mandatory in the development process. Customer requirements for e-learning materials are compatible with the curriculum and encyclopedia knowledge. This is especially the case for the requirement of covering the curricula 100%, which may not be productive.

Students gain knowledge by using computer equipment that is continually improving. This increasingly higher quality e-learning material is accessed by a click of the mouse. A richness of computer screens and virtual coverage of curricula with interactive elements may alienate the students from the real goals of the school (education). Using too many e-learning materials and online courses could change perception of learning and the educational processes could lose sight of their pedagogical aims (Duh and Krašna, 2010). We do not have a conclusive answer to whether interactive e-learning materials will change the interaction between the teacher and students. Additionally we cannot confirm that individualism in handling e-learning materials with computers will have an impact on the healthy collectiveness of a classroom. But we do know that we cannot achieve emotional upbringing goals or educational goals with e-learning only. It is known that contemporary curricula for primary schools include much ballast (redundancy), yet e-learning materials need to cover them perfectly. Even teachers using these e-learning materials find that it is impossible to achieve functional knowledge using only one source. Students become bored using the same kind of learning materials all the time, while it is nice to have them and use them occasionally. Another question that applies here is: “Can we achieve a successful upbringing and education with the mouse only?” We still think that this is a black scenario and we must prevent it from happening.

5 Aesthetic and didactic communication

In modern upbringing and education e-learning materials are designed to activate audio, haptic and video sensations. The most important is the visual element, since it has been proven that less time is required to assimilate a picture message than is required for verbal assimilation (Schuster, 2000). Therefore it is most natural that the design of e-learning materials should mostly be based on visual stimuli. Words can explain almost everything but we cannot erase the fact that the world is around us, therefore the relation between what we see and what we know is never solved (Berger, 2008). Using e-learning materials attract visual capabilities and demand organised observation, as well as mental, emotional and other activities. Multimedia elements in this aspect widen cognition, educational-upbringing, and cultural-technical and social functions. The right combination of multimedia elements can enhance the effectiveness of educating and raising children (in the aspect of breadth and depth) (Duh, 2004). With this in mind every computer screen should follow the principles of quality in aspects of technical levels, graphics-aesthetics and creativity. The creative design of e-learning materials should have the following attributes:

- applicability
- novelty
- suitability.
Applicability is observed from a pedagogical – didactical point of view. A novelty is when an idea is new, rare and extraordinary. It has a positive effect on the motivation of learners. Suitability or relevance means that e-learning materials are designed with the problem-solving principle in mind. From previous research we have come up with questions that e-learning material designers should answer before a project goes into the implementation phase: (Duh and Krašna, 2009a)

- What is the whole structure of the e-learning material?
- Is the content didactically suitable?
- How will the computer screen be perceived from a learner’s point of view?
- Is the use of the e-learning material intuitive?
- What media will be used for visualisation?

In the visualisation of e-learning material, the choice of media should be done using an aesthetic-creative approach. Specialists in fine arts should be necessary members of the development team. A critical approach should be fundamental to the design of any project that develops e-learning material. Fine art starts with the selection of an existing image and illustration and continues with the designing of new ones, production of movies and animation and the design of interfaces and navigation tools (Kirschennmann, 2004). Computer interfacing is a complex operation of the unity of information across multiple screens. The relation between the product (e-learning material screen) and the aesthetic reaction to the computer screen produces an extraordinary sensation and surprise. It is the wish of every e-learning material developer that this surprise is satisfaction.

For e-learning material to be creative developers should follow these principles: (Kvaščev, 1976)

- novelty (personal and social)
- number of products
- size
- new implications
- surprise
- immediate and long-term social, economic, scientific and informational value.

E-learning material should confront learners with textual and visual data during the introduction or intermediate sequences. The learner does not have an influence on this content but can change the sequence. Such an approach is called receptive identification (Fritz, 2006). Despite this marginal effect the learner can identify with the content and perceive it as common sense and become motivated for further research. Intermediate control questions have a reward effect and provide additional motivation. The joy of a transparent and organised computer screen with new content can increase intrinsic motivation. The transparency and organisation of a computer screen can be achieved with the position of the visual elements in the virtual rectangular grid. Such organisation gives a necessary static and psychological simplicity and has a tendency to isolate (Seyler, 2004). But grid order can cause an optical burden if the distribution of images is not
vibrant and rigid. More important elements should therefore be positioned outside the virtual rectangular grid. Learners never watch only one item on the screen. They always perceive it as a whole since their vision is always active (Berger, 2008).

No matter what the content of the e-learning materials is, criticism from the point of view of fine arts should be taken into account. It is a known tendency in natural science that this option is omitted as unimportant or not applicable (Kirschenmann, 2004).

The most known deficiencies from a creative aesthetical point of view of e-learning are:

- The graphic design of the computer screen must be viewed as a whole and graphic elements must adhere to distribution, colour, readability and legibility.
- Multi-perspective views of the navigation buttons, images and bevel of text disturb learners.
- Distribution of screen elements and overcrowding the computer screen is disturbing.
- Typography should be carefully designed and conservatively used on computer screens. Too many typography changes on the computer screen is disturbing (i.e., bold, underline, colour, font face and size variations). The right typography increases legibility and readability.
- Images and video should be post-processes. Raw images and video are not suitable because they often include ‘educational noise’ and the quality is questionable.
- Graphic elements (schemes, animations ...) must be attractive and satisfy even higher art standards.

6 Real world experiences

We are going to use the e-learning material just covered to start a discussion on the misuse of e-learning material. Topics about the technical requirements and comments from reviewers will be given.

Technical requirements for the e-learning materials specify that e-learning materials are packed in shareable content object reference model (SCORM) packages (see Figure 6) and is easily transferable to another learning management system (LMS) Ministry of Education and Sport of Republic of Slovenia, 2010; Krašna et al., 2009). The reviewer had complaints that we did not provide the links between different SCORM packages. Inside the package the navigation is self-explanatory and clearly visible (see Figure 7). This is possible to achieve, but it will compromise the portability.

We wanted to replace mouse clicking, therefore we included worksheets which have to be filled in. We used a form type of document that is used extensively in project applications and official forms (see Figure 8).

Free text in worksheets gives students the necessary freedom of expression. On the other hand teachers have a more active role since they need to check the creative work of their students. Teachers have varying ways of gathering the assignments from their students. Documents can be uploaded to the LMS, send by e-mail or printed and discussed in the classroom. Anyway we wanted our students to get familiar with the digital forms.
**Figure 6** The structure of the e-learning materials in Moodle (see online version for colours)

![Diagram of Moodle structure](image1)

**Figure 7** A topic from the e-learning materials (see online version for colours)

![Topic from Moodle](image2)

Notes: We see the navigation with a different colour on the button and we see where we are within the chapter on the header.
Figure 8  A worksheet that needs active student involvement and not just mouse clicking (see online version for colours)

Notes: This type also involves teachers into the active role of reviewing the students’ assignment.

Figure 9  Quiz (see online version for colours)
For self testing purposes we introduce quizzes. Quizzes should be a bit harder to solve and the answers should not be trivial (see Figure 9). In this way we prevent the student from leaving the quiz to go search for the right answer. If a student wants to leave the quiz, the system locks the entry to the quiz again.

7 Conclusions

Designing e-learning materials is a challenging task. It requires the cooperation of many specialists. Technical specifications have shown to be easier to solve than those that deal with aesthetics. Different research has confirmed that attractive e-learning materials are easier for the learners. Learning materials should not just be attractive; they need to address the topics of semantic noise (legibility, readability, navigation and visual effects). At the same time they need to actively involve learners so as not to give the wrong impression about learning. E-learning materials will not replace teachers for a foreseeable time in the future. We have found that students like such materials, but not as something permanent and not for the whole curriculum. This is because today’s generations need different stimuli and require different perspectives of their learning materials. Developing learning materials with different perspectives seems unprofessional; therefore we need to have different types of learning materials. Teachers will use them according to the social climate in the classroom and must play an active role in guiding students through the e-learning materials and prevent students from getting the wrong impression that learning only amounts to mouse clicking. Quizzes are for self-evaluation and must not be trivial. In our opinion, open text assignments give more intellectual stimuli. Teachers play an active role in the review of students’ responses and need to check and penalise them when they just copy/paste texts from the web. Successfully proven e-learning materials in practice provide good didactic communication and should be a guideline for every e-learning materials design project.

References


