Educative contents, development methodology

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Abstract: In this paper we expose our experience in the creation of different types of educative contents and the methodology used in their development. This methodology is exposed taking into account the needs of the development team and considering the available resources. These educative contents are delivered using a multimedia learning management system. They have been created for a project called *IESCampus,* developed as an extension of the project *Prometeo,* an initiative promoted by the *Quality and Educative Innovation Vice-chancellorship* of the *University of Las Palmas de Gran Canaria.*

1. Introduction.

The introduction and use of New Technologies in the learning field does not only imply that the process should be structured, planned and that it should be done according to the more adequate criteria. On the one hand, we must work in the educative contents, their creation process, features and objectives because these contents are, with no doubt, an essential part in the process that will lead us to increase the quality of learning. On the other hand, these new technologies should be used for something else, like introducing new elements that help in the teaching-learning processes.

If we relate the concept of innovation to educational technology, we can consider innovation as the systematic method of designing, applying and evaluating a set of teaching-learning processes, taking technical and human resources and the interactions between them into account at the same time, as a way to obtain a more effective education (UNESCO, 1984)

E-learning applications' importance is increasing in the educative field, but there are still some critical questions that should be solved in order to make use of the potential offered by the new web technologies (C.Guerra, M.D. Afonso, F.M. Hernández, J.T. Milán, 2007). The methodology to create interesting content and the different types of educative materials that can be developed in order to hold the interest of students are the main goals of this work.

2. Learning Management Systems vs. Multimedia Learning Management Systems

A Learning Management System is a software application accessed through a web server that, making use of web technology, manages and broadcasts educative content to support the training that takes place in the classroom and the distance learning activities.

A Learning Management System can broadcast different types of educative material: text files, slides, animations, audio and/or video files or even software applications. It can manage the access to these contents, for example: the participation in forums, answers to questionnaires or the access to the information by the different users.

The multimedia learning management system developed in this project is characterized by being composed of different modules that store information about students' actions. One of the modules that make the platform different is the player. The multimedia player not only reproduces the file using video streaming[1] (T. Hartsell, S. Chi-Yin Yuen, 2006) but it also interacts with the students as teachers usually do in the classroom to be sure that they are paying attention to the speech (R. Rheeder, R. Diseko, G. Lautenbach, 2007). The player shows the video slots viewed by the students. A time slot is considered viewed when the student gives the correct answer to a question displayed by the player, at that moment the player stops the video, displays the question and waits for an answer for a few seconds. If the answer is correct the video player stores the time video slot viewed from the last correct answer up to the current one. If not, the time slot is not stored. This activity of the player is called *visualization control* (H. Samaras, T. Giouvanakis, D Bousiou, K. Tarabanis, 2004). There are other functionalities that characterize the player, like the possibility of making notes in different parts of the video.
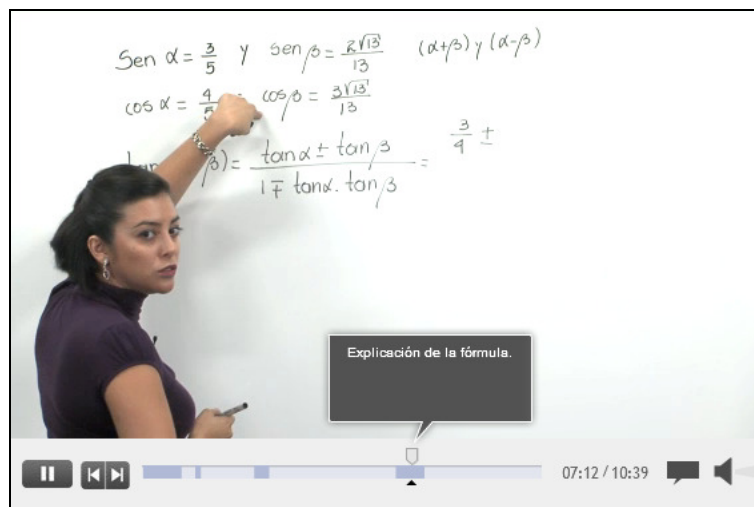

Figure 1. Multimedia player.

3. Educative contents

Educative contents enclose, in different digital formats, the materials used in the teaching-learning process; a multidirectional process where knowledge, value, habits and proceedings are transmitted from one generation to another. This way, individuals develop physical and intellectual abilities, skills, study methods, and behavior codes.

As learning theories and teaching-learning processes have considered new technologies in their exposition, educative contents, a main part in these processes, should make use of them both in the creation process and its manage and broadcast.

To work and research in the educative contents' development methodology, their creation process, features, and objectives will lead us to increase education's quality.

In the IESCampus project the development of educative content has begun with the subject *Mathematics I,* (B. Broughton, E. Chacko, L.L. Lim, 1999) corresponding to the first year of the baccalaureate (G. Lautenbach, 2007).

3.1. Multimedia.

Multimedia educative contents broadcasted through the Internet offer a great opportunity to enhance the teaching-learning process (Karen Fraser, 2006). The large-scale creation of multimedia educative content should be

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1 Multimedia content broadcasting, on demand, through Internet. It is a delivery method that allows the visualization of this kind of content directly on the web page, with no need of a previous download

tackled through a structured process (R. Pedrosa, S. Petitz, 2007) (J. Casteleira, P. Leão, 2007). This is necessary due to both the great variety of contents we can find within a lesson and the different resources that will be needed.

3.1.1. Types of multimedia contents.

Amongst the different types (C. Guerra, F. M. Hernández, M.D. Afonso, M. V, Aguiar, 2008) of educative contents that can be created we find:
- Podcasts
  They are audio files which contain information or some section of a lesson. The scripts are a very important part of those resources because it is essential to think how to give expression to the idea of the educative content that lecturers want to convey. At first these files only contained audio but nowadays they are used to distribute digital media files, video and/or audio. An important advantage is that students can download these files from the Internet and listen to them or even watch the video at any time and any place.
- Screencasts
  They consist of video files where the recording of the computer screen is shown often including the corresponding audio narration. They are really suitable to show, for example, how to work with a software application.
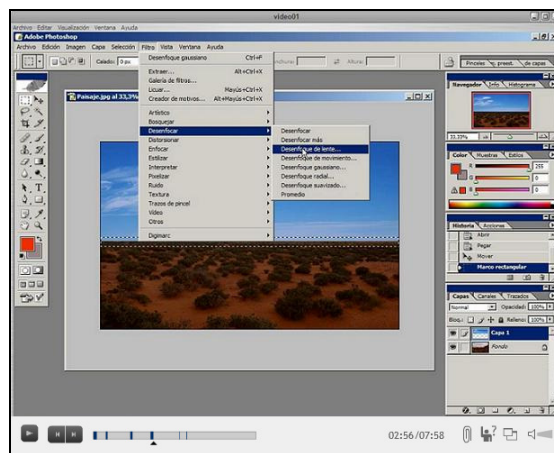

Figure 2: Video screencast.

- Video recordings at the studio
  There exist different types of video recording at the studio, which are chosen taking into consideration the material to be produced:

  - Video recordings using blackboard. The lecturer makes use of a blackboard.
  - White background. Lecturers talk to the video camera. Nuclear-white background is the one used in the video recording. This type of recordings will be edited later in postproduction. They will include texts and images detailed in the script; usually by animated slides.
  - Using chroma key[2]. The lecturer, talks to the video camera. The chroma key will allow in postproduction to add images that will become part of the background.
  - Set. Where either two lecturers or a lecturer and a guest take part. Some dialogues are presented as the exposition of a lesson or some section of a lesson.

- Video recordings in location shots
  It is necessary a previous visit to the recording location, as well as knowing what type of route will be made throughout the setting; where the stops will be made according to the script and what types of stops these will be. The routes' speed can change, according to the place of the setting where they are taking place. The stops can change as regards to its length; they can be made to record only images –the audio can be added later- or they can be made to record the lecturer showing a device and talking about its features or handling.

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2 Technique used for mixing two images or frames together. When mixing one of the colour from one image is removed or made transparent, revealing another image behind it.

Visits to factories, business companies, some museums, locations where fauna and flora are shown, types of soils, buildings or constructions, amongst others, will take part in these contents.

▪ Video recordings in labs or classrooms

Like video recordings in location shots, in labs or classrooms it is necessary to visit previously the location in order to know the recording material to use: lights, types of video cameras, or tripods and lenses.

Among these types of recordings we find experts' talks. When different experts are invited to talk about their experiences or to make a speech, all these talks are recorded to be distributed later in multimedia format through a web platform which includes forums. Invited experts will attend the forum of their lecture for a few days.
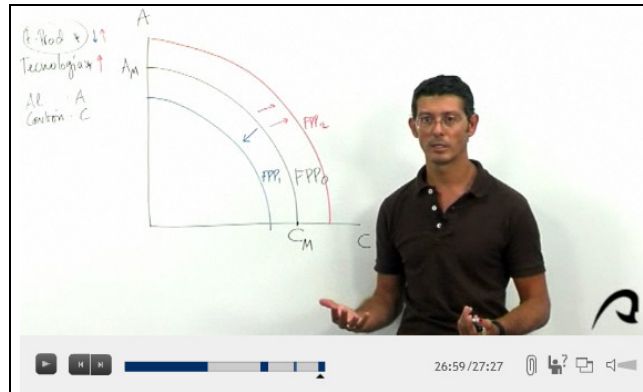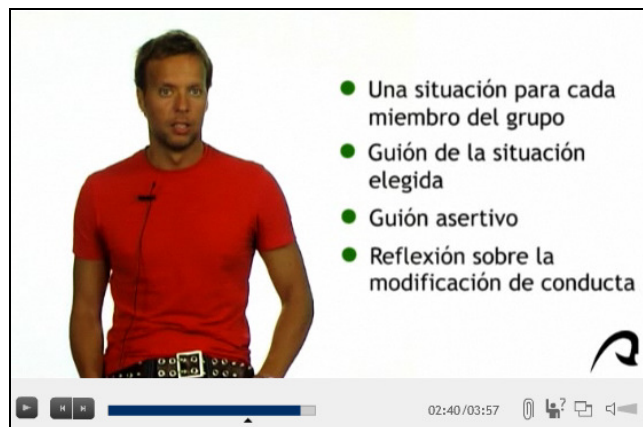

Figure 3: Video using blackboard.
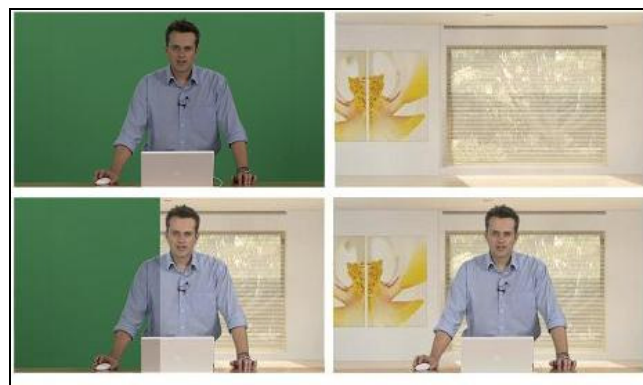

Figure 4: Video using white background.

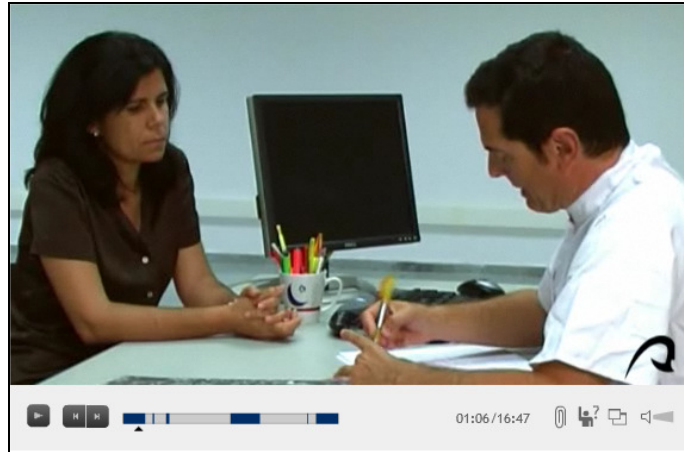**Figure 5**: Video using chroma key.

Figure 6: Video using a set in the studio.

Figure 7: Video recorded in a lab.

Figure 7: Expert's talks.

3.1.2. Methodology.

The recordings used in the subject *Mathematics I* of the IESCampus project have taken place in the recording studio: using blackboard, screencast and white background.

The different phases in the contents' creation for a lesson are:

- Configuration. At this first stage the different sections of a lesson are identified. The material is selected according to the official books used in high schools.
- Edition. The text corresponding to each section of the lesson is edited, and the interactive software applications are defined.
- Preparation. The classroom speeches to be recorded at the studio are prepared with all the three techniques: using blackboard, screencast and white background. The rough videos using blackboard last between 5 and 30 minutes. Those videos using screencast or white background do not last more than a few minutes. These are edited embedded in the ones that use blackboard, because they are used to show some graphical example.
- Recording. Recordings are made at the recording studio. Once they are finished, they are reviewed in situ in order to make the necessary corrections.
- Development. Interactive software applications that will compose the different exercises of each lesson are developed.
- Design. The web page is designed including all the content, in order to be distributed through the learning management system. This can be made using templates.
- Reviews. Text and interactive software applications are reviewed.

3.2 Interactive Software Applications

Interactive applications are developed with the goal of making students interact with them (C. McHugo, T. Hall, 2006). This way the student can create a mental model of how it works. The learning process, in this case, does not come simply from reading and understanding a concept, but from the understanding of its behavior. Its creation process has also been systematized.

3.2.1. Types of interactive software applications.

Amongst the different types of interactive software applications that can be developed we find:

- Presentations:

    where the interaction of the user with the application is limited to move forward and backwards in its different sequential stages.

- Active exercises:

    where the interaction with the user is higher. The student can move sliders, introduce data, activate or deactivate buttons or links, amongst others, in order to check their correct running.

    - Static active exercises. Each time they are executed, the exercise presents the same interface and offers the same options to the user.
    - Dynamic active exercises. Each time they are executed, input data can change and, therefore, the interface can also change as well as the user's options.

Another classification allows us to establish the difference between those that interact with the database and those that do not interact. The first ones store information about each user's results and actions. The second ones do not have any interaction with the database.
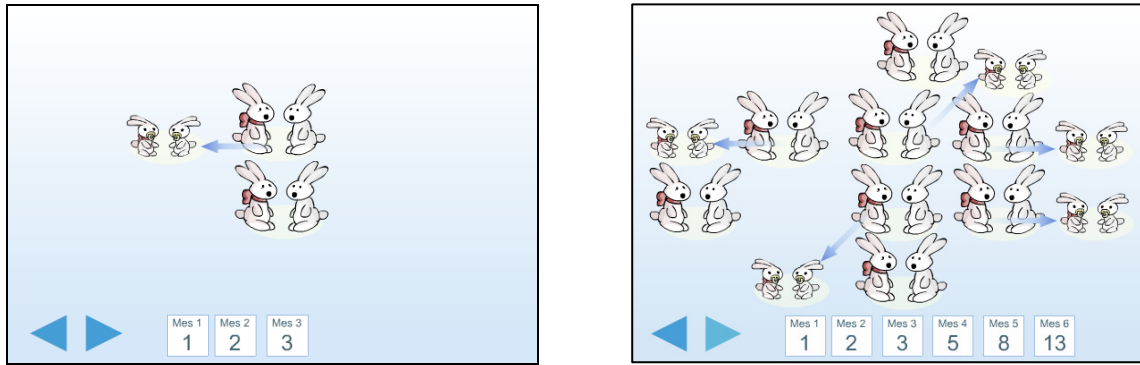
Figure 8: Presentation.

This presentation shows how the Fibonacci numbers are generated. The sequence of numbers is represented by rabbits. The user can clicking in the right button, then the numbers of rabbits is incremented each month.

The sequence was studied by Leonardo of Pisa, known as Fibonacci, in his Liber Abaci (1202), (Sigler, Laurence E. (trans.) (2002). He considers the growth of an idealized (biologically unrealistic) rabbit population, assuming that:

- In the "zeroth" month, there is one pair of rabbits (additional pairs of rabbits = 0).
- In the first month, the first pair begets another pair (additional pairs of rabbits = 1).
- In the second month, both pairs of rabbits have another pair, and the first pair dies (additional pairs of rabbits = 1).
- In the third month, the second pair and the new two pairs have a total of three new pairs, and the older second pair dies (additional pairs of rabbits = 2).

  The laws of this are that each pair of rabbits has 2 pairs in its lifetime, and dies.
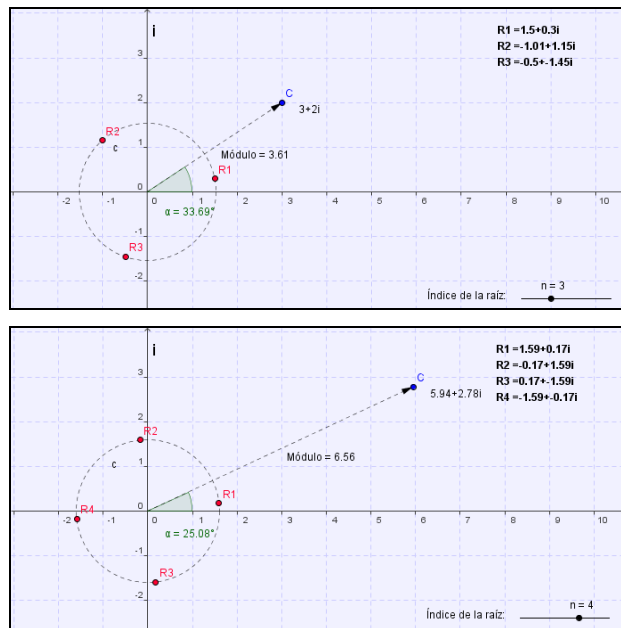

Figure 9: Static active exercise.

In this exercise the student can move the C point on the screen and select the number of roots to be shown.

- 3 roots of C = 3+2i are calculated
- 4 roots of C = 5,94+2,78i are calculated.

Figure 10: Dynamic active exercise.

In this exercise the student should solve the equation. When the exercise is generated randomly, the number of roots may change, in these cases, the interface will change too.

3.2.2. Method.

The interactive software applications developed for the subject *Mathematics I* of the Project IESCampus have been both presentations and active exercises.

The creation methodology has been getting more systematic from the beginning of the project until now.

Nowadays the different phases followed in their creation are listed below:

▪ Edition. The statement of the problem is written, according to the analysis made together with the teacher.

▪ Definition. Random variables and their range are defined and those variables that are calculated based on them are identified. Random variables are those that change randomly in each iteration of an exercise.

▪ Development. In this phase procedures and formulae are developed. They calculate the results of the exercises in order to create the programming code.

▪ Correction. In those cases where it is needed, *special correction methods* are introduced. On most occasions, in order to check if the result is correct, it is only necessary to compare the results. In other cases a *correction method* is needed, the *special correction methods*. For example: when the result is 1/2, could also be 2/4; or in those cases where the results are infinite, as to give the points of a geometric line.

A work team of six professionals is working using this methodology:

The teacher of the subject explains the analyst-programmer what the application should do.

The analyst-programmer makes the analysis and design of the application. Later the programming code is created.

Four of these professionals, amongst them teachers and software programmers, review the applications created.

4. Experience and conclusions

In this paper we expose the different types of multimedia contents and interactive software applications that can be used in the teaching-learning processes. The project in which these contents and the proposed methodologies

have been created is still in its first phase of development, although the working team has experience in large-scale projects developed for the university scope.

The users of these contents created for high schools have a different profile from university students. High school students are digital native. They have a great capability to pay attention to different tasks almost at the same time: to read digital documents, chat, listen to a video or podcast, send electronic mails or even to find information on the Internet. Therefore they have a low capacity to focus their attention on just one source. This way the videos created for them are small if we compare their length to the length of those created for university students; and the software applications used to teach are interactive and attractive, in order to make them focus their attention on what they should learn.

The contributions of this work to educative contents are:

▪ It improves the broadcast of the contents. The web platforms used are composed of modules, developed with the aim of making the most of its possibilities.

▪ All the planning process of the different phases allows the use of the resources, both human and material, properly.

▪ By using the adequate professional profile for each task we achieve the best results. The professionals will use the more suitable techniques in edition, recording, design, analysis, development, tests batch and maintenance.

▪ It improves the quality of the material created, because the reviews are made by a multidisciplinary team. These reviews are one of the creation process' phases.

Nowadays the work is focused on a deeper research in different types of contents and their creation methodologies, with the objective of developing the material for the rest of the subjects at high schools; and also to systematize the creation processes with the aim of making an adequate use of the resources and to maximize the results (Bill Shackelford, 2002).

The project will be at user's disposal (teachers, students and parents or tutors) during the academic year 2009-2010. Once the project starts different studies will enclose results about their use and the adaptation to them. In the province of Las Palmas, where this project will start, there are 612 high schools (J. Sánchez, A. Salinas, O. Purcell, L. Pérez, 2009). After the period dedicated to contact them, we hope that at least a 10% of these high schools will work with this project. After studying the results a scheduling will be made for the rest of the provinces.

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