

## Multimedia Activities for Homework and in-Class Exercises

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*Abstract:* - A subject in any degree course has 4 main parts: Lecturing classes, hands-on skills, homework exercises and in-class exercises. Homework and in-class exercises have the objective of the reinforcement of the knowledge learned in lecture classes. Generally, these problems or exercises are presented written in a paper or, sometimes, in an electronic format using a word processor. Despite of the type of exercise or problems proposed for the students, we suggest the use of multimedia activities as a medium to propose these exercises. In this paper we will show different kind of multimedia activities that can be used for homework and lecturing classes exercises. This classification will allow us to choose the type of multimedia activity depending on the type of knowledge it is wanted to transfer to the student. These multimedia activities have been used in the subjects “Redes de Área Local” and “Integración de Redes” that can be taken in the third course of the Telecommunications Technical Engineering in the “Escuela Politécnica Superior de Gandia”. Results given by a questionnaire answered by the students are shown.

*Key-Words:* - Multimedia Activities, Homework, Lecturing classes exercises, TICs for the education.

### 1 Introduction

In-class and out-of-class exercises are one of the most used ways by the lecturers to make the students practice about the lasts lessons [1]. Some of this type of exercises could be:

- Problems
- Study cases
- Short questions
- Tests
- Search for a specific information
- Draw-up a report
- Make a summary
- Brief oral presentations
- Brief writing exercises

Although there are many more not so much known [2] [3], they are the main ones. This type of exercises could be used to motivate the students [4], to provide the students with some direction for a bigger project [5] or for exams preparation [6]. Actually, the main issue in using exercises in the classroom it the time needed to prepare them and the time needed to solve them [7]. On the other hand, there are many methodologies that can be used for in-class exercises such as active learning and collaborative learning [8].

From several years ago, there have been published some works were communications and information technologies are introduced. On one hand, some works show the use of computers to do the in-class exercises [9] [10] and to test the skills [11], others

propose the use of tablet PCs to make the exercises [12] and, lastly, there are some works that show the use of PDAs in the lecture classes [13][14][15].

On the other hand, it is known that the use of the multimedia technology enhances the comprehension of the lecture because of its visual and sound impact on the student. There are many works where multimedia activities are used to support the subject [16][17][18] and for class presentations.

In this paper we will show a new type of in-class exercises that are quick to solve and easy to use (it can also be used for homework exercises). Instead of using a new software or a complete education platform to do the exercises, we propose the use of the Adobe Flash software [20]. It is versatile and allows us to deploy high quality activities that can be used in our theoretical classes as presentations, demonstrations and even for exercises while having files with very low size. This technology is actually used by virtual laboratories because they can be run either locally or remotely using a web server. We are going to use it to deploy in-class exercises.

The remainder of this paper is as follows. Section 2 describes the concept of the virtual laboratories and gives its main features. Some multimedia flash activities developed for “Redes de Área Local” and “Integración de Redes” are shown in section 3. Section 4 shows how we use the multimedia activities in the classes. Section 5 shows the student’s

impression about the activities and our analysis about their answers. Finally, in section 6, we will give our conclusions and future works.

## 2 Virtual laboratories and e-exercises

A virtual laboratory is a local simulation that can be run locally or remotely. It allows simulating phenomenon and physical models, abstract concepts and so on [21]. It gives the possibility of showing interactively the mathematical model and the simulated model. It tries to become closer to a real environment. The virtual laboratory allows obtaining an intuitive and clear view of the phenomenon helping its understanding.

A virtual laboratory shows the instruments and devices through dynamic objects (Java applets or flash, cgi-bin, javascripts,...), images or animations [22]. The virtual laboratory uses the computer processing capacity and computer calculus in order to show the numerical and graphical results of the simulation.

Some of the main benefits of the virtual laboratories are the following ones:

- Makes easy and gets closer the experiences to great number of students because they have not to be in the same place at the same time [23].
- Students can make changes without any risk.
- The laboratory will have a flexible time, so the overflow is avoided.
- Reduces the setup and maintenance cost.
- It is a self-learning tool where the student varies the input variables and configures the new experiments.
- Students learn by proving and solving mistakes repeating the practice as many times as they need.

But, on the other hand, virtual laboratories have several drawbacks:

- A virtual laboratory doesn't substitute the practical experience. The virtual laboratory just complements it.
- A virtual laboratory has to be accompanied by a guide to avoid having the student as a spectator and driving him to achieve the goal of the practice.
- Because the virtual laboratory doesn't use real devices, the student misses a little bit of the reality

This type of technology can be used to do in-class exercises. One of the main issues in in-class exercises is that writing takes too much time [24], so we should consider other strategies to use inside the classroom such as e-exercises.

e-Exercises (also called online exercises) are self-quizzes that give the opportunity to increase the student's skills in many areas. E-exercises have to be done in a computer and they can be placed locally like at home, computer laboratory or classroom, or in a remote server. The main feature of the e-exercises is that they are easy to use and don't need too much time to be solved.

The e-exercises increase the teaching diversity and act as an efficient complement of the most conventional methodologies. E-exercises help to achieve the objectives pursued for the subjects.

## 3 Multimedia flash activities as e-exercises

The Flash Player is a simple and useful player for viewing flash on your computer freely without any cost. It can play any .swf file in any platform, navigator and devices (mobile devices included). Flash Player is distributed with the main software companies such as Microsoft, Apple, Netscape, AOL, Mozilla Firefox and so on, so flash animations can be viewed by the most common web browsers.

Adobe Flash [20] allows you to create interactive multimedia, including audio, video, animations, puzzles and so on. In order to develop a Flash activity, a developer must follow the following steps:

1. Decide which basic tasks the application must do.
2. Create and import the multimedia elements such as the images, video, sound, text, etc.
3. Organize the multimedia elements in the Macromedia Flash software environment and in the timeline. The developer has to define when and how they are going to appear in the application.
4. Apply special effects to the multimedia elements as it is wanted.
5. Write ActionScript code in order to control the behavior of the multimedia elements and their response to the user interactions.
6. Add interactive elements like text fields or buttons in the application.
7. Add a short program to implement the functionality for the textfields and/or buttons.
8. Test the application in order to determine how it works and to find possible errors.
9. The edited flash document is in .fla extension, so it is needed to create the compressed version in a .swf file in order to show it in a web page and to play it using the Flash Player.

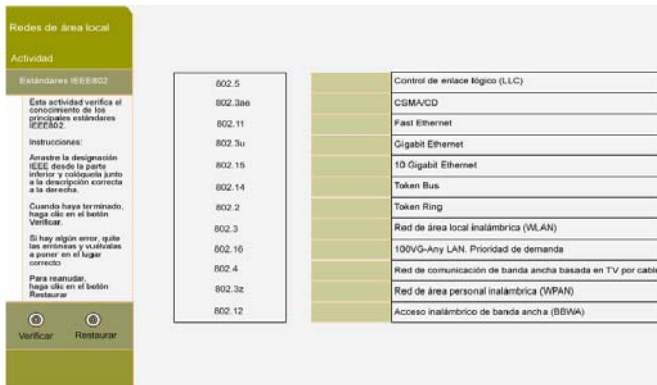


Figure 1. Multimedia activity of IEEE standards.

We have developed several multimedia flash activities. We have found many benefits using them:

- Lecturers can check the students' knowledge.
- Students can check their knowledge.
- Students can use them to practice what they have been learning last days.
- Students can practice with exam-type questions.

Figure 1 shows a multimedia activity used to relate the number of the IEEE standard with its description. In this activity students must move the number of the standard to the correct brown box. There is only one number for each description. Once all the numbers are moved to the boxes, the student have to click on the verification button. A green mark appears when everything is right, but if any box is wrong, it is marked with a red cross.

Figure 2 shows an activity used to know the procedure that has to be performed in each step when an e-mail is sent. In this activity, the frame encapsulation steps are reviewed. The student has to move all boxes in the right to the correct place to make sense. Once they are placed, the student has to verify the activity by clicking the verification box.

Figure 3 shows an activity that is formed by several slides. In the first slide the student has to give the type of medium, the type of connector and the maximum speed for some IEEE 802.3 variants, for 802.5, for some FDDI variants and the 100VG-Any LAN standard. In the second slide the student has to give the same parameters for some IEEE 802.3u and IEEE 802.3z variants, and, finally, in the third slide, it is the same but for some IEEE 802.3ae variants and for the IEEE 802.11a/b/c. Each slide is validated separately and wrong boxes will be marked in red.

In figure 4 we can see 3 buttons. Depending on the button clicked, the student will have to solve the specific part of the problem. In each zone, the student has to choose the MAC address and the IP address for the source and the destination field of the frame. Only when the correct fields are placed, appears an animation indicating that the frame travels from the source to the destination.

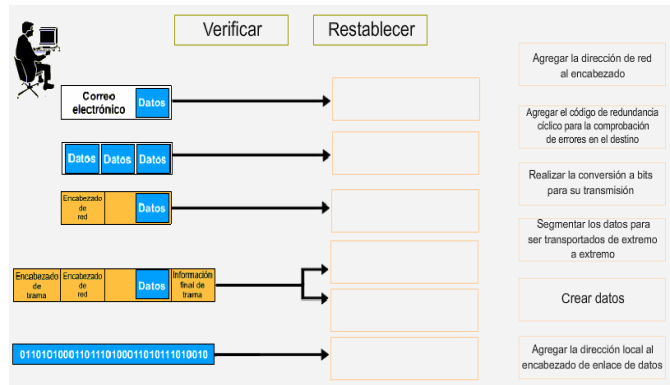


Figure 2. Multimedia activity of encapsulation steps.

Figure 5 shows figure with a topology where the student has to write the number of nodes, number of links, the grade of the nodes and the diameter of the topology. When the verification button is clicked, the system gives the student which values were wrong. This activity has 32 different topologies and the student can go to anyone of them by clicking the "next" button.

Figure 6 shows a troubleshooting multimedia activity where the student has to find which device has failed in the network from the man to a specific destination. The question of this activity is shown when the mouse is put over the question mark of the figure. The student has to ping the devices till he/she finds which part of the path is wrong and decides what the problem is.

## 4 Educational methodology

The educational methodology used in the classroom was as follows. Every time a chapter is finished we present these activities to the students requesting their participation. It can be in the last 15 minutes of a class or it can be the whole hour of the class. It depends on the number of activities available for that chapter and on how is going on the schedule time of the subject. When a student answers correctly the activity it receives 0.2 points as quick as the question is answered. Although the answer of many activities can only be right or wrong, depending on the answer of the student and on the student's reasoning, 0.1 points could be added. No more that 1 point can be gathered by just one student. It allows balancing the number of points among the students.

A student can't answer an activity day two times the same unless no other student wants to answer the activity. It allows giving the opportunities to all the students, not only to the ones that give fastest reply.

The points obtained through the course are added to the student's final mark only if the student has more than 4 points out of 10 (in Spain an exam is passed if the student obtains more than 5 points).

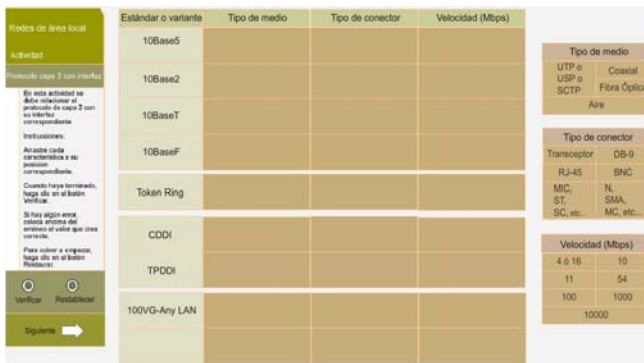


Figure 3. Multimedia activity of IEEE variants.

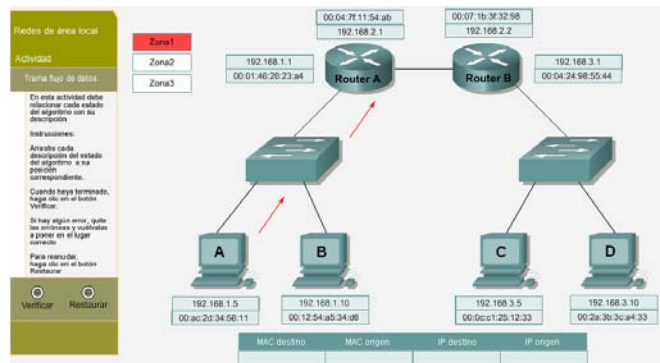


Figure 4. Multimedia activity of frame fields.

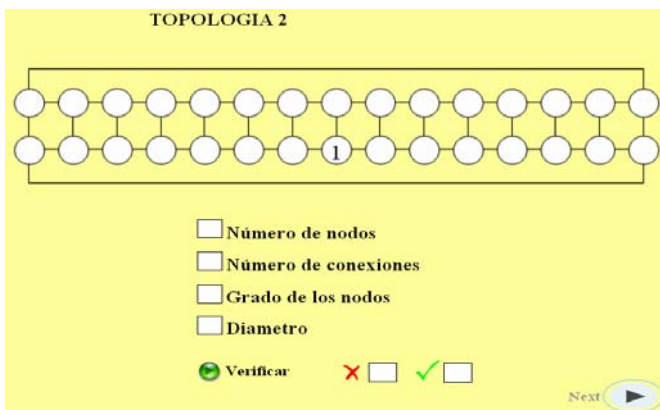


Figure 5. Multimedia activity of topology parameters

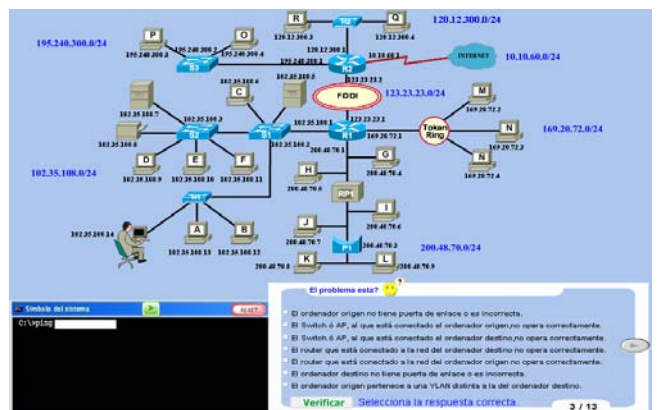


Figure 6. Multimedia activity of troubleshooting.

## 5 Measurements and analysis

In order to check the performance of our new methodology, we gave the students a questionnaire to gather their opinion. It was given in two classes (first one was in the first semester of the course and the second one in the second semester). Then, we measured and analyzed the answers of the students.

### 5.1 Questionnaire

First, we gave 8 questions to the students and they had 5 possible answers to mark them (1 = None, 2 = Little, 3 = Some, 4 = Quite, 5 = Very Much). The questions given to the students were:

1. Do the multimedia activities have helped you to understand better some concepts of the subject?
2. Are they easy enough to understand and to use?
3. Do you consider that to give points to the final mark for good answers in the multimedia activities is a good idea?
4. Do you think that the number of multimedia applications presented in class is enough (or would it be better to add more)?
5. Do you think that it could be a good idea to place these multimedia activities in an on-line server and the answers will be sent to the lecturer when the students carry out them?
6. Could the multimedia activities be used as method of the students' chapter evaluation?

7. Do you prefer to do the multimedia activity instead of doing the same exercise writing them?
8. Do you like how the multimedia activities have been corrected (in the class and with the presence of other students)?
9. What do you think about the different format of the multimedia activities (moving blocks, etc.)?
10. Do you think that to carry out multimedia activities after concluding each chapter is good?

### 5.2 Questionnaire results

The questionnaire was performed in two subjects, the first one was “Redes de Área Local” from the first semester and the second one was “Integración de Redes” from the second semester of the third course of the Telecommunications Technical Engineering of the “Escuela Politécnica Superior de Gandia”.

From figure 7 to figure 16 the average values obtained from both subjects is shown. They show the grade of satisfaction of the students. Just in question 2 and in question 6 the most masked answer was “quite”, in the others was always “very much”.

## 6 Conclusion

We have shown a new methodology based on the utilization of multimedia activities. The questionnaire presented to the students show that it has been a good initiative to improve our classes.

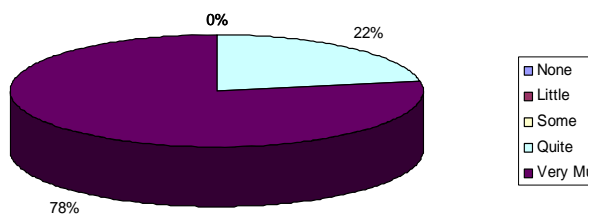


Figure 7. Results of question 1

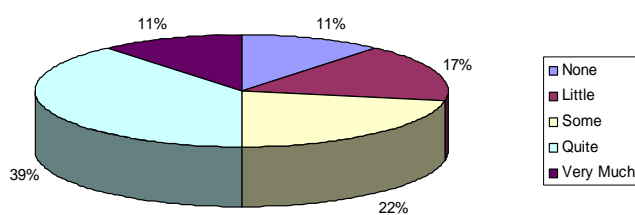


Figure 8. Results of question 2

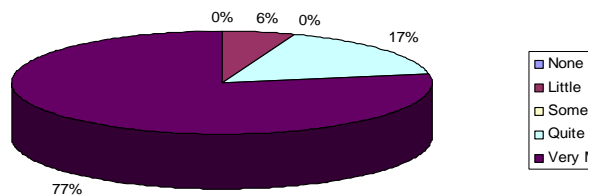


Figure 9. Results of question 3

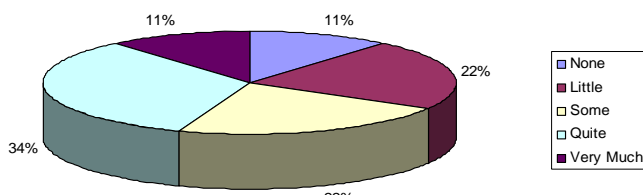


Figure 10. Results of question 4

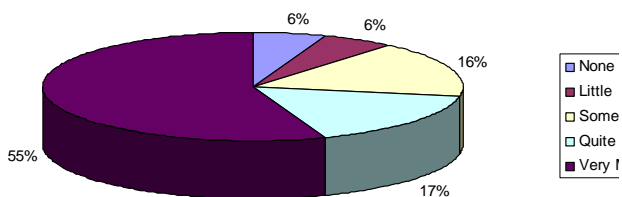


Figure 11. Results of question 5

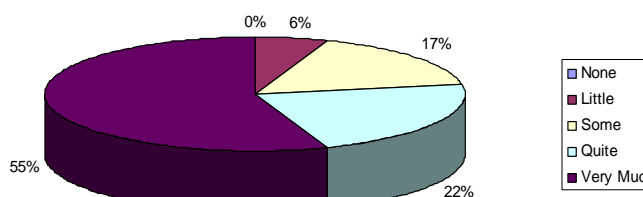


Figure 12. Results of question 6

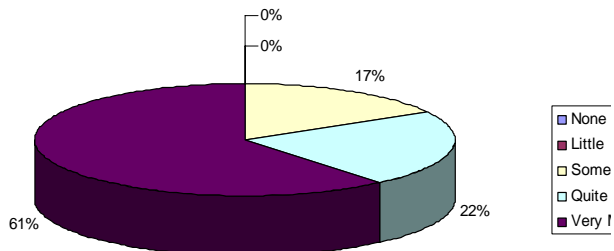


Figure 13. Results of question 7

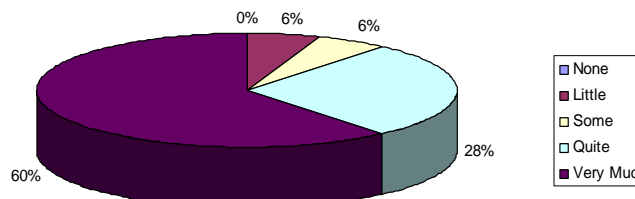


Figure 14. Results of question 8

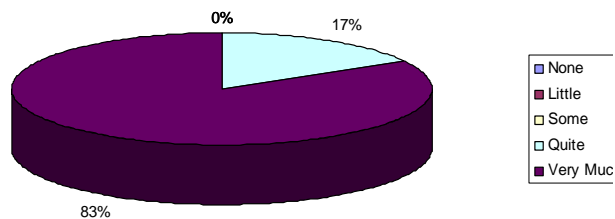


Figure 15. Results of question 9

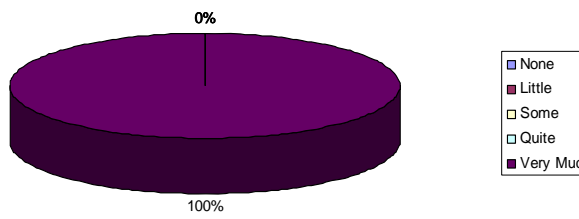


Figure 16. Results of question 10

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