Using Applets in an Optics Course: Students' Perceptions

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Abstract

We report the student's perceptions related to the use of applets with educative intention in an Optics course context. The course is a partially web-based having both types of learning activities: face to face and web-based ones. In some of them, the students must use interactive elements (applets) in order to solve the proposed activity. We focus our analysis in one of these interactive elements. Student's perceptions in the use of this applet have been collected by means a paper questionnaire. The use of the applet is very well accepted for students The reasons given for such acceptation can be classified by different categories: communicative arguments, cognitive and comprehension ones, and academic ones. Students' perceptions, of their role in the teaching-learning process when using applets, have also been detected.

Introduction

Ten years ago, the expectations concerning of using Internet, the www and computer support systems in general were very high and some people thought that students would use the web as prime mode of study. Nowadays, we know that those predictions have not been accomplished and there is still a short use of the web in formal educational situations. During the last five years a lot of papers have been published based on research on web-supported instruction. However, there is scarce research about the implementation of web-based resources in relation with specific disciplines and in particular in the context of science education. This fact contrasts with the amount of web-based contents free available through the web.

In the case of Physics, it is worthwhile to mention the applets, small simulations made in Java. Just a simple search by means Google gives about one hundred thousand web pages including lists of shareware java applets for Physics. In general most of these objects agree with the definition of simulation given by diverse authors of Science Education [1][2][3][4]: to simulate Physics phenomena in an invented environment, allowing the users interact with it and modify parameters, variables, rules, etc. and, in some cases, they can also measure different magnitudes.

Often, the applet webpage includes only instructions for using it (start, change parameters view graphics) and it is rarely contextualised in a learning activity to attain specific learning goals. It seems like if their colourfulness, their spectacular view, further the fact that by 'clicking' in some place something happens, were a guarantee of their suitability as learning tools.

The study presented here tries to explore the educational potential of those objects, from the point of view of the students of a partially web-based Optics course.

1 Learning environment

The course is being offered since 2000 to around 30 engineering students. It has a hybrid structure: besides the web-based environment, there are face-to-face sessions. Students accede to the contents through proposed web-based learning activities. These activities are designed to guide students in their learning process and, to a certain degree, to assess their achievement of the established learning outcomes. Some of these activities use an applet to visualise and simulate optical phenomena.

The core of the course is the basic geometrical optics: optical systems, thin lenses, focal and principal points and ray tracing. During the course the students use different applets in the context of the following activities:

1. The light. How does it reflect? How does it refract?
2. How does an optical fibre work?
3. Focus in spherical mirrors.
4. Imaging by a spherical mirrors.
5. Focus in optical systems.
6. Images in an optical system.

An applet, when is properly guided, can be used in different learning situations, to achieve different learning outcomes.[5], [6]. This is the case of the activities 3,4,5,6, where the same applet "Optics Applet", designed by W. Christian [7], is used. This applet, which is based in paraxial optics, simulates an optic bench and allows users to observe the ways that light rays propagate through different optical elements (mirrors, lenses, objects, light point sources and light beams). Students can interact and modify the characteristics of the optical elements.

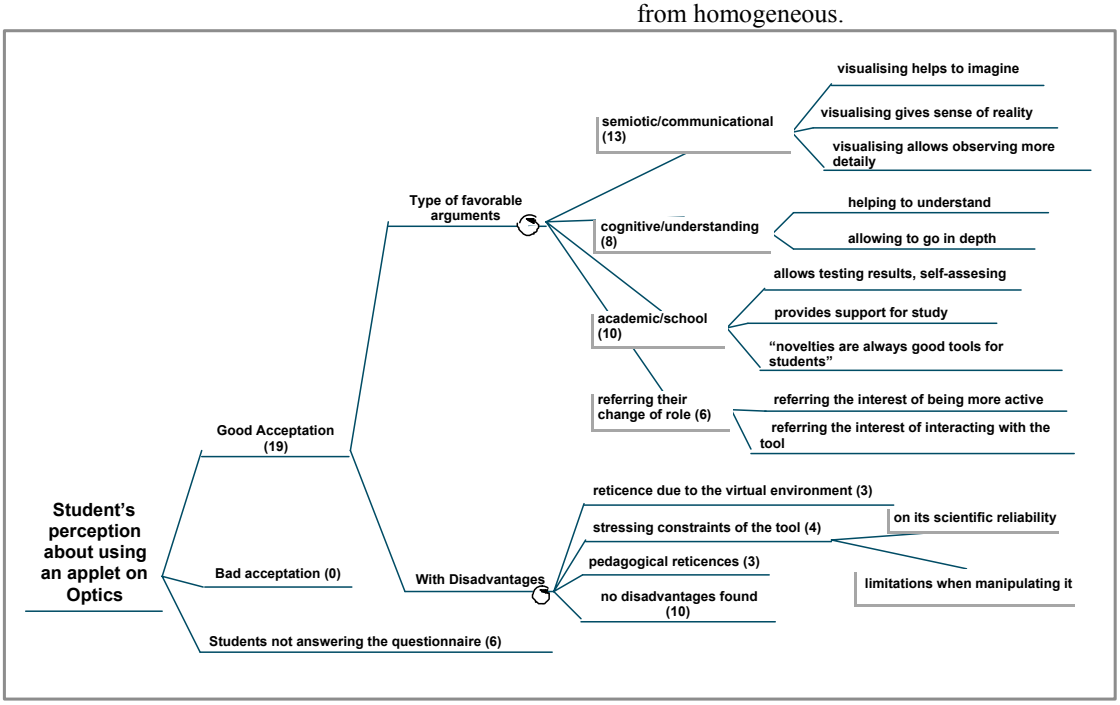
2 Evaluation procedure

After having evaluated since the beginning the students' perception of the whole course, the use of the web as an educational environment, and their opinion of usefulness of the proposed web-based learning activities

[7], we decided now to understand better the students opinion about the use of applets incorporated in some of the activities. A questionnaire (with five open and five closed questions) was administered during the last semester. The questions were established to recall the students' reactions from the Optics Applet, whether they have followed the instructions for using it and when and whether they consider to have understood or not the meaning of the applet and what it represents.

3 Students' perceptions

The below systemic network shows the kind of answers got when asking students' perception about the use of applet. Most of the students agree with the interest of using the applet even though their arguments are far from homogeneous.



Many of them appreciate very much the possibility to visualize the optical phenomena, sometimes conceived as a way of understanding. Even so, the most of the students are thinking the applet as a tool for their academic purposes; different arguments (10/19) evidence their idea of using the applet as an interesting way of doing school exercises. Bright comments we found from students expressing the problems presented for the tool due its constraints

Other answers, got from the closed questions, revealed that students are not experienced in the use of applets (14/16 have never used before), the instructions to clarify how to operate with the tool are only used for half of them, however all of them feel able to understand how to proceed and also the meaning of the proposed actions. Moreover, further to use the applet for doing the proposed exercises, the applet has also been used freely as a tool in other circumstances, as a resource to solve questions.

Conclusions

Students appreciate the use of the applet on Optics in the process of learning, they feel comfortable with its use and are able to identify and exploit its potentialities applying them in other occasions. Software constraints are rarely considered

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