RED INTERUNIVERSITARIA DE INNOVACIÓN DOCENTE EN LA ENSEÑANZA DE LA ÓPTICA Y LA FOTÓNICA

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ABSTRACT

Networking means to **interconnect people sharing** an interest in the success of a particular enterprise. We present our **Innovative Education Networking** which develop learning tools for Optics and Photonics. The network is composed by **University of Alicante**, the **University of Miguel Hernández in Elche** and the **University of Valencia**. The academic networking staff is expert in Optics and Photonics teaching. Other student **demands multimedia applications**, in that sense we are developing several online materials based on video-tutorials of laboratory experiences, also different activities to enhance students creativity and interest in Optics and Photonic. That will result in **interesting educational synergies** between universities and promote student autonomy for learning Optics.

MOTIVATION

This picture summarized very well our motivation. Students are demanding changes in the way of teaching. Now due to Higher Education European program, academic methodology focuses o the **student autonomous learning** rather than in the role of mere information receptors

1. INTRODUCTION

Bologna process has transformed teaching methods and structures in **Spanish Higher Education** in the last seven years. In that sense, students **need many new tools and teaching material** to accomplish such **autonomous learning process**, because there is some evidences that traditional approaches are **ineffective in teaching physics concepts**, including **light and optics** concepts. Electronic Learning or e-learning is a type of technology-supported education **learning using computer technology** such as online classrooms, however one of the main drawbacks is the lack of social interaction. In that sense, blended learning (b-learning) combines both technology and regular teaching methods (face to face lessons, lab sessions, guidance and coaching).

A "network" according to the meaning here is a **web of interconnected** people sharing an interest in the success of a particular enterprise. Photonics educators can benefit from being better connected to each other, not just to information. In that sense, the department of Policy Training and Educational Quality of the University of Valencia, in Spain, has bet **on innovative education networking**. The requirements to apply for that kind of innovative project is to be minimum ten teachers and **three universities from Spanish territory**. The aim of our network is to develop b-learning tools for Optics and the network is composed by University of Alicante, the University of Miguel Hernández in Elche and the University of Valencia. We are a consolidated network and the University has granted with innovation projects since last 4 years (UV-SFPIE_DOCE14-222505, UV-SFPIE_GER15-314280, UV-SFPIE_GER16-418575 and UV-SFPIE_GER17-589019). In Fig. 1 we show our hoe web page where all those learning tools are linked together.

Figure 1: Snapshot of the Innovative Education Group home page (www.uv.es/ioptica)

2. VIDEO-TUTORIALS FOR SELF ASSESMENTS

The video format is **familiar to students**, contains a wealth of spatial and temporal data, and provides a bridge between direct observations and abstract representations of physical phenomena. Video-tutorials enhance and **speed up the learning process** due to the visually easy followed procedures step by step. In fact, we started to work on video-tutorials due to the **insistent student demands**. Laboratory experiences related to the image formation through optical systems is fundamental to understand the subject properly. Solving the problems in the laboratory should help you explain many of student daily experiences with the concept of light rays that travel from sources or illuminated objects in straight lines and suffer refraction through prism, parallel plates, lenses, etc

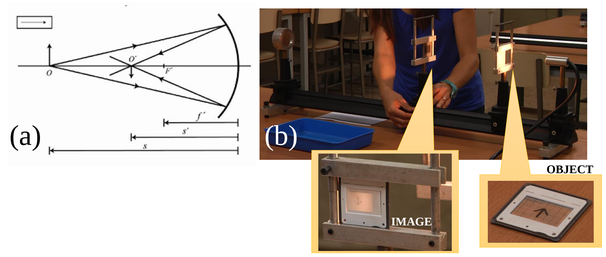

Figure 2: Different snapshots of Geometrical Optics Lab video-tutorials

Video-tutorials have a duration of **ten minutes** approximately. At the beginning of the video-tutorial we review the theory and we clarify the objective of the practice. Then, we show the different optical components that are needed and we implement the experiment putting special attention in recording the relevant parts of the experiment.

3. INTERACTIVE LEARNING MULTIMEDIA EXERCISES

The student is offered a set of 24 exercises solved using only **graphical tools** for optical ray tracing. The approach of each exercise is based on a **multiple-answer operative scheme**, which can only be answered correctly after the graphic resolution of the problem. Prior to the approach of every problem, a brief theoretical introduction is advanced, which contextualizes such problem

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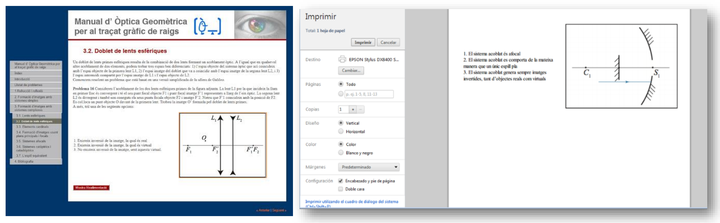

Figure 3: Different snapshots of Interactive Learning exercise

The interactive tool that we developed has the additional objective of impact very directly on **non-attendance and independent study of a student**. For this reason, this tool is mainly based on problem solving specifically designed for self-study. The material incorporates the necessary elements that allow students to know the degree of success in solving the proposed problems

4. LEARNING OPTICS IN NATURE AND DOMESTIC EXPERIMENTS

The students perform photographs made by themselves with scientific content and illustrating physical phenomena learned in class of Optics. This makes students much more involved in learning by transferring the theoretical contents to their domestic and everyday environment.

We organized at the faculty, a picture competition and we gave three different awards, depending on the optics theoretical content, as well as visual and original photographs.

Figure 4: Exhibition of photographs at the Faculty of Physics (University of Valencia) May 2017

5. PHOTONIC EXPLORER AND OUTREACH ACTIVITIES

We also develop several outreach activities using Photonic Explorer Kit

6. CONCLUSIONS

- An **innovative education networking** involving academic staff from three Spanish universities linked together around **Optics and Photonics** has created thanks to the department of Policy Training and Educational Quality of the University of Valencia
- This possibility is a **real synergies between universities** to share materials and facilities for **improve teaching** around Optics.

REFERENCES

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