Available online at www.sciencedirect.com
ScienceDirect
Advances in Space Research 41 (2008) 217–222
ADVANCES IN SPACE RESEARCH (a COSPAR publication)
www.elsevier.com/locate/asr

Development of educational CD-ROMs in astronomy: Information on a collaborative project

Valerie Frede *

UFE Paris Observatory and ECCD-Octogone EA4156. IUFM, 56 av. de l'URSS, 31400 Toulouse, France

Received 8 September 2004; received in revised form 26 June 2007; accepted 27 June 2007

Abstract

The observatory of Paris and the institute of teacher training (IUFM) in Toulouse have collaborated to develop multimedia support for astronomy lessons. The goal of this project is to provide additional didactical material such as CD-ROMs to elementary and high school teachers which will be used by children in the classroom. In this paper, we present the aims of the project and describe briefly the contents that have been developed so far.

The project is a part of "Astrophysique sur Mesure", a broader project led by the observatory of Paris which encourages the involvement of astronomers in the development of pedagogical tools.

Keywords: CD-ROM; Learning environment; Elementary and high school; Astronomy

1. Introduction

This paper describes an ongoing collaboration between the observatory of Paris and the institute of teacher training (IUFM) in Toulouse to develop educational CD-ROMs. As an example of this project, we present the development of two CD-ROMs for the teaching of astronomy in school. The project belongs to a broader one called "Astrophysique Sur Mesure" led by the observatory of Paris as a numeric campus. The web site presenting the global project can be found on http://media4.obspm.fr. The numeric campus includes materials (mainly with Internet files) for university levels ("Astronomie pour l'Université en ligne » for the first years of University; « Fenêtres sur l'Univers » for licence level; « @strophysique pour la maîtrise » for master level; « Laboratoire numérique pour l 'école doctorale » for Ph.D. level); and also materials for elementary and high school teachers and students ("Astronomie pour les IUFM"). Wondering about the declining interest of young students for scientific studies, the observatory of Paris has the will to develop training program and pedagogical tools in astronomy. The UFE team (Training Teaching Laboratory) of Paris Observatory is thus developing educational tools for various school levels (university, high school and elementary school) principally using numerical format (Internet files and CD-ROM) involving both astronomers and educators.

Today, astronomy has to be taught at various school levels as it belongs to the curriculum of both elementary and high school. Very few targeted material is available for teachers in France, they are mainly textbook based products. There is a real need to develop astronomical didactic materials under numeric format to complete and enhance the existing resources. The specific project of our study concerns the development of CD-ROMs in collaboration between the observatory of Paris (UFE team) and the institute of teacher training in Toulouse (IUFM Midi Pyrénées (ERT 34 team)). The institute of teachers training has skills in didactical conceptions and evaluation of educational products but also in cognitive psychology studies dedicated to the use of hypermedia products ("learning with hypermedia"). The collaboration between

* Tel.: +33 5 62 25 20 75.
E-mail address: valerie.frede@free.fr

0273-1177/$30
doi:10.1016/j.asr.2007.06.054

astronomers and educators under the form of scientific interaction between astronomy, didactic and cognitive psychology, is particularly fruitful for the development of relevant learning tools.

From this collaboration, three CD-ROMs will be developed. They are designed to be used at school by the students in the presence of teachers. The first one is now finished (it corresponds to the lower high school level (collège in French)). The second one, devoted to elementary school children, is nearly finished and the last one for upper high school is still in its theoretical conception phase. We will discuss the aim of the project relying on examples from the lower high school and the elementary school CD-ROMs.

The choice of developing CD-ROMs for schools and not to use Internet files relies on the reality of French schools equipment. Indeed, even if now lots of schools have at least 3 or 4 computers, a very few of them are equipped with Internet connection or if so, the connections are very poor and working on Internet is not an easy task. For these reasons, at this date, the CD-ROM format appeared to us the most appropriate to be used in the majority of French schools. The resources development for teaching astronomy at school is not a new idea, there already exists several other CD-ROMs or Internet based products developed by research centre such as NASA for instance (CD-ROMs: Astronomy Village; http://www.cet.edu/products) or UCAR (Windows of the Universe; http://www.windows.ucar.edu). Nevertheless, to our knowledge, first no such Internet sites or CD-ROMs are available in French language and second those products are not designed to fit to the specific French curriculum about astronomy. For these reasons, it appeared to us important and necessary to develop materials relying on the French specific curriculum for the three main school levels, to use French language and to present the results on a CD-ROM format in order to avoid logistic difficulties of some schools. There already exits several astronomical CD-ROMs in French but they are not designed for a direct use in schools and they do not follow the curriculum. Usually educators do not want to use such "general public CD-ROMs" because, on the one hand, they loose too much time to adapt their content to their lessons and on the other hand, they do not have enough time to work on parts that do not belong to the curriculum. This point was also reported by Knudsen (2003) in a study where she highlights a number of difficulties that educators find when they want to use CD-ROMs in their classroom. She provides then recommendations for the development of quality products for education.

In a first part of the paper, we will present the main goals of the project and the different steps we followed in the conception process of a multimedia product. These points will be illustrated by a short presentation of the CD-ROMs for "college" (lower high school level) and for elementary school. The last part of the paper is devoted to the general presentation of the evaluation process of a multimedia product by the definition of the utility, utilisability (also called usability, Nielsen, 2000; Squires and Preece, 1996) and acceptability. We will explain how those criteria could be applied in the future to our CD-ROMs to help us improve them.

2. Goals of the project

The main goal of the project is to provide teaching tools easy of use by students and teachers in class and targeted on the French curriculum in astronomy. The learning goals are thus that student find an adapted content to acquire the fundamental astronomical concepts described in the curriculum. The decision to develop the CD-ROMs based on the exact curriculum of each school level was possible thanks to the collaboration between astronomers, that could develop precise and quality contents, and educators that could adapt those contents to a school public following the curriculum.

The CD-ROMs are designed to be composed of several elements linked to a same concept in order to offer a good level of interactivity (knowledge text, going further text, history text, image, video, animated illustration of a dynamical movement, flashed-based interactive to develop inquiry activities, 3D views and different perspectives on a same object thanks to interactive movements, worksheet for the student). In that way, the CD-ROMs can offer data and presentation that a textbook cannot. Nevertheless, the aim of our educational CD-ROMs is not to replace the textbook at school but rather to enhance the available material by completing it and offering non static views of specific contents. We expect that the CD-ROMs will help the construction of knowledge, mainly thanks to a nonlinear possible path in the contents and the use of dynamical illustrations and interactivity. Indeed, we tried to provide animated or interactive pictures or to show videos when a dynamical process needed to be explained, because it was shown that the use of animated illustrations gives a better understanding than static representations (Mayer and Moreno, 2002). Nevertheless, we made the choice to use a simple interface, mainly for the high school level CD-ROMs (screen presentation and page structure), and similar to what the student is used to find in his books in order to facilitate the learning process but also to be a more familiar and convenient tool for the teacher.

Indeed, the products can be used by the teacher as a help for identifying the main concepts to teach in astronomy and as a library to prepare his lessons. Even if astronomy has to be taught at schools, teachers receive very few training about that matter. In fact, the teachers we met reported that they usually felt embarrassed with the textbook material because of limited or poor documentation. It does not help them in the elaboration of their astronomy courses (children have numerous questions about astronomy and teachers have to find the information alone, they sometimes understand with difficulty the dynamics of phenomena from the book, and they need clear didactical