The New Technologies in the Teaching of Geometric Optics

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Abstract. The multimedia applications store and represent data - that may include text, sound, graphics, moving and constant pictures, video - in any combination. Therefore, their utilization in the instruction of Physics constitute a strong tool, for the improvement of teaching and learning process. However, it is absolutely essential to combine these potentialities of new technologies with some suitable pedagogical planning.

The main aim of this work is to present a teaching tool, which can considerably contribute in the comprehension of basic significances of Geometric Optics - a subset of Optics dealing with the attributes of light.

Keywords. Geometric Optics, Multimedia.

1. Introduction

The smooth incorporation and the simultaneous complete exploitation of new technologies, in all rungs of education, constitute the main components for the improvement of educational process. The pedagogical exploitation of this innovation, shapes a new, not only original but also continuously evolving environment of teaching and learning, which has as main characteristic the different instructive approach regarding the traditional teaching.

The teaching in Natural Sciences and more specifically in Physics is one of the most remarkable and wide fields to investigate the potentiality of new technologies. This is due to their experimental dimension, to the difficulty in solving various problems and even more to the requirement of teaching using multiple representations. Therefore, there is a very strong necessity for the creation of certain instructive tools, which will help the students, among other things, to approach the conceptions and laws of Physics, to exercise not only in the observation but also in the interpretation of several natural situations and phenomena, to develop intellectual and practical skills, to cultivate critical thought while they will appreciate and the important role of Natural Sciences in the growth of technology.

The multimedia applications store and represent several data, which may include text, sound, graphics, moving and constant pictures, video - in any combination. Therefore, their utilization in the instruction of every cognitive field - and more specifically of Physics - constitute a very strong tool for the improvement of teaching and learning process. The nonlinear representation of information, in combination with the students' potentiality for a free choice in approaching data, directs us to their multiple applications in the classroom. Besides, the utilization of a series of simulations provides the students with the potentiality to import and/or stabilize different parameters each time, in order that the picture of phenomenon under review will be presented with the most completed way. This activity influences positively the perception of the students for the natural phenomena and allows a qualitative approach for the representation of a real situation.

However, it is acceptable that just only the technology will not guarantee the effective learning – on the contrary, an erroneous use is possible to create serious problems. Consequently, it is absolutely essential that each advanced training environment must combine these potentialities of new technologies with some suitable pedagogical planning in such a way that it will offer the best possible result. The technology should be an important supporting tool and not the central focusing point of the training process.

2. The authoring software

The application of the article is materialized in a special software system – Macromedia Authorware 6.5 – which is enlisted in the category of software systems for the concretization of applications – authoring software – and its operation is based on a set of

icons and tools - icon based, event driven tools. This program of creating applications, on one hand, is easy to learn and very friendly to use, while, on the other hand, is providing a strong potentiality to concretize very complicated interactive tasks, either in cd or in the internet. As a result, the Macromedia Authorware software system is classified first in the category of authoring programs. Also it should be reported here, that all the simulations of this application have been created in the environment of Visual Basic programming language, which is an object oriented programming language with a relative easiness in learning while at the same time gives a lot of possibilities to the programmer.

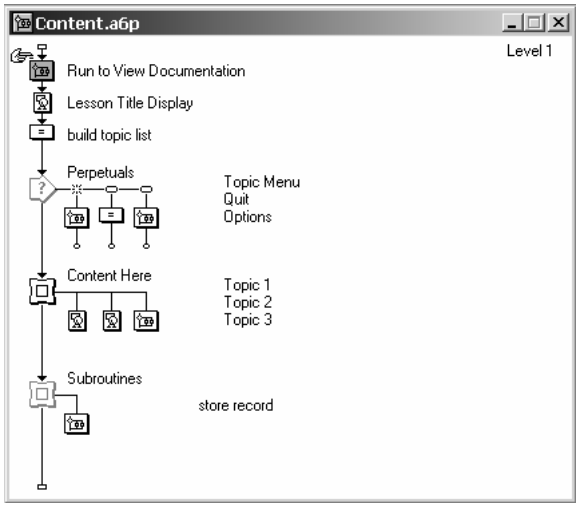

Figure 1. An autonomous section of a flow chart

Initially, the flow chart is created – flow line – according to some script, which must be determined by the writer of software. Depending on the script, the flow chart is continuously extended with icons that correspond in facts, tasks, graphics, sound, text, video, choices and decisions of the final user. This annexation of various icons creates an important series of facts, actions but mainly interactive decisions. As a result, the planning of whole application and especially the potentiality of the predetermination of alternative choices is given to the author so that the system will either react or interact depending on the choices.

The software authoring system utilizes libraries in order to optimize the management of certain resources of the system. Concretely, some often-used files are not integrated into the main executable program but they are called, whenever it is judged essential, with subsequent result in saving space. Also, because the multimedia files – and more specifically those containing sound and video – are very exigent in memory space they can be linked – instead of incorporated - with the main program or the libraries.

Finally, in regard to the creation of interactive pages, the navigation icon provides the potentiality both of the successive presentation of pages and the automatic transfer in a non-serial content via hyperlinks.

3. Concretization of application

The main and important aim of this work is to present a teaching tool, which can considerably contribute in the comprehension of basic significances of Physics – and more specifically of Geometric Optics, which is a subset of Optics and deals with the attributes of light. Even though, there is no clearly defined framework in respect to the requirements, which must be satisfied by any educational software, a few basic governing rules should be followed in order that the software will be considered worth mentioning.

➢*Instructive and Pedagogical Design*

✓ It follows the directions in the analytical program.

✓ It corresponds to the levels of students to which it is addressed.

✓ It supports the experiential approach of knowledge.

✓ It actively involves the students and facilitates their experimentation.

✓ It contributes in the growth of the creativity of students.

✓ It improves the intellectual and practical dexterities.

✓ It cultivates the critical thought.

➢*Design of Screens and Choice of Sound*

✓ Uniformity in the creation of screens.

✓ Stabilization between the interconnection and the individual units.

✓ Elimination of monotony during the design.

✓ Explicit determination for the utilization of every object on the screen and avoidance of any information that may disorientate the students.

✓ Careful selection of the sound in order to influence positively - as much as possible - the disposal of students.

Figure 2. The introductory screen of the application

➢*Interaction and Feedback*

✓ Design, in detail, of communication between the students - or the teacher - and the educational software.

✓ Layout of information in a non-linear form.

✓ Articulation of content in units with a hierarchical structure.

✓ Design of direct feedback that should be on the screen with the question or the answer of student and customized to his needs.

➢*Content*

The content of all educational software should correspond to the training level of student, to which it is addressed and must be formulated with clarity and precision while it should not contain irrelevant, to the unit, information. The organization of the content, in structured units, is as follows:

✓ *Historical Elements* – information about the researchers, which dealt with the particular subject and collectively, formulated the relative theory.

✓ *Nature of Light* – report to most basic theories for the nature of light and examination of all relative phenomena, such as the reflection, diffraction and speed of light.

✓ *Geometric Optics* - report to both the converging and deviating lenses as well as to their systems. Also, certain worth mentioning applications of lenses are presented, such as the photographic camera, the eye, the microscope and the telescope.

✓ *Bibliography* – report to the original resources from which was derived the relative information.

✓ *Activities* - creation of activities that aim at the complete comprehension of all the relative significances and phenomena, such as classification, exercises on completion of phrases, e.t.c.

✓ *Search* – finding of any word or phrase wherever in the existing text via an automatic electronic index.

✓ *Dictionary of terms* – explanation with some helpful information on any of the relative significances.

✓ *Simulations* – presentation of a fictitious laboratory in order that the user will formulate and check each relative, to the theory, hypothesis.

✓ *Animation* – presentation of various moving pictures in order that the user will consolidate, schematically, all the relative significances.

✓ *Information* - report to the members of the research team as well as some other relative informative elements.

✓ *Exit* – completion of the application.

Finally, at any point of this application, if it is judged essential, it is given help, which is relative to the choices of the student at the particular point. At the same time, the possibility to keep notes is provided for future use, at any point of the application.

4. Conclusions

The planning and the concretization of educational multimedia software, which supports the teaching on the unit ‘Geometric Optics', was created with both exceptional attention and particular care so that it fulfills all the required objectives. Also, the entire application has been used to support teaching of some particular units of Physics, in certain schools at Rethymnon, Crete, with very satisfactory results. The main objective of the research team in D.P.E, University of Crete, is on one hand, the improvement and on the other hand, the progressive extension of application in order to be incorporated a bigger percentage of units of Physics. Because this particular type of applications has a lot of advantages, which it is impossible to be offered by any book, the full concretization of this idea will constitute, on one side, an innovative tool of learning for the improvement of educational process and on the other side, a driver for the revision of teaching of Natural Sciences.

5. References

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