

The Use of Virtual Reality in Virtual Learning Environment

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Abstract: This work presents an experience in the use of Virtual Environments of Learning in Descriptive Geometry teaching. An environment was created based on HTML, compiled with HTML Help Workshop of Microsoft, that unites theoretical contents in the hypertext form and visual tools as photos, animations and Virtual Reality. The use of this sets, into the class room, together with new evaluation forms it increased the approval level and the quality of the approved students' learning. These techniques can be used in several other disciplines of several courses and not only of Engineering, always where there is need of sophisticated visual resources.

Keywords: learning environment, virtual reality, Descriptive Geometry

1. Introduction

The use of traditional techniques of teaching has been showing ineffective in the teaching of Descriptive Geometry [1]; it disciplines fundamental in Engineer's formation. The Descriptive Geometry requests the use of visual tools for its best understanding, because it is three-dimensional geometry with high complexity degree. Traditionally, the used visual tools are models (scale models) of the objects in study and projections of pictures or drawings. Such procedures are useful, even so the use of models is costly in its implementation and maintenance and the classes with projections are tedious. An economic alternative to the use of real models and the projections is the use of virtual models in Virtual Reality Environments. Of course a Model in Virtual Reality doesn't substitute all the advantages of a real Model, even so the variety of virtual models that can be created and the possibilities of models visualization are limitless. This turns its advantageous use, because it is possible to create models of objects and situations in study with a lot of easiness through the use of programs CAD. Many of these programs allow to create files of VRML [2] type. Such files cannot, for example, to be available by internet and to view in most popular Browsers.

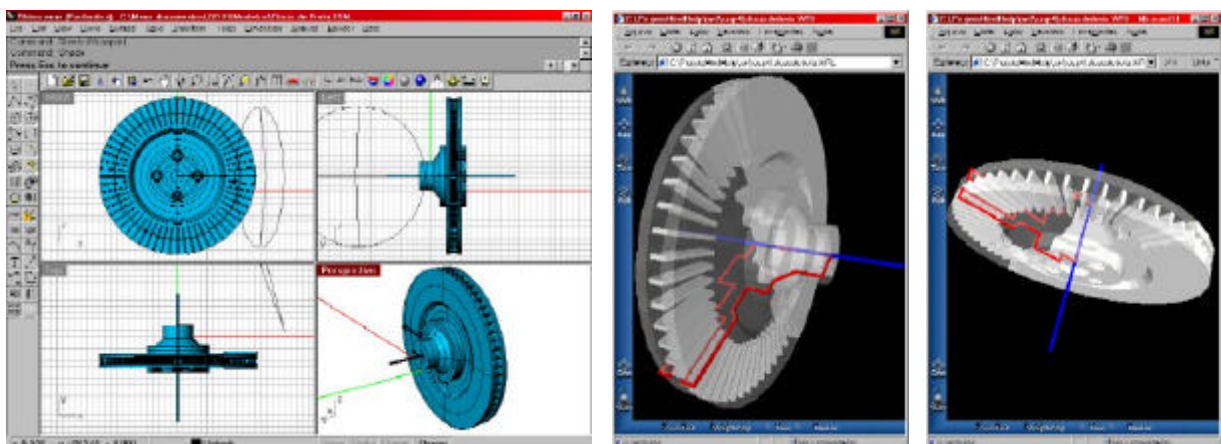


Fig. 1. Model generated in program CAD 3D and exported in VRML it can be visualized in browser.

The use of these new technologies should be accompanied of a change of teaching methodology so that the revenue of the process teaching-learning has the wanted effects.

2. New methodological approach.

The Descriptive Geometry teaching, based on the traditional techniques, possesses a bass approach upward, where the student should imagine a three-dimensional object starting from your plane projections. For this to be possible, it is necessary an abstraction capacity that most of the students didn't still develop. It is a paradox, because to develop such capacity it is one of objectives of Descriptive Geometry teaching.

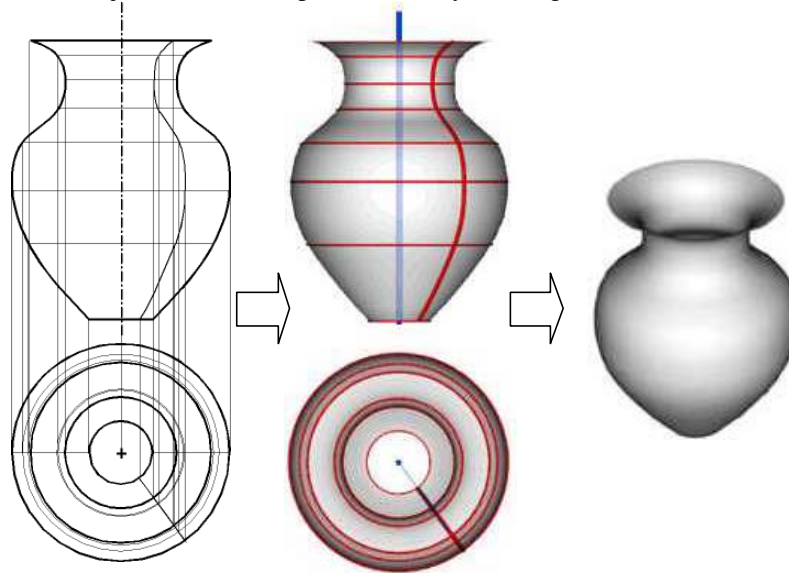


Fig. 2. In the traditional Descriptive Geometry teaching the student should imagine the real object from its projections.

An approach inversion, now top-down, leaving of real (or virtual) three-dimensional objects until the construction of your plane projections, it creates a natural road for the student to build his knowledge and develop abstraction capacities based on the logic and knowledge. The teaching-learning process grows in three stages: in the first stage the student knows the real object in all your details and your properties; in the second stage the student learns to build the projections of object starting from real object; in the third stage the student builds the projections and solves problems just knowing the properties of the real object.

The first two stages are fundamental for the student to develop his abstraction capacity. The third stage is only possible due to the acquired knowledge in the previous stages and objectives to exercising the abstraction capacity and the logical reasoning through the solution of problems directly from the projections of real objects without its 3D graphic visualization.

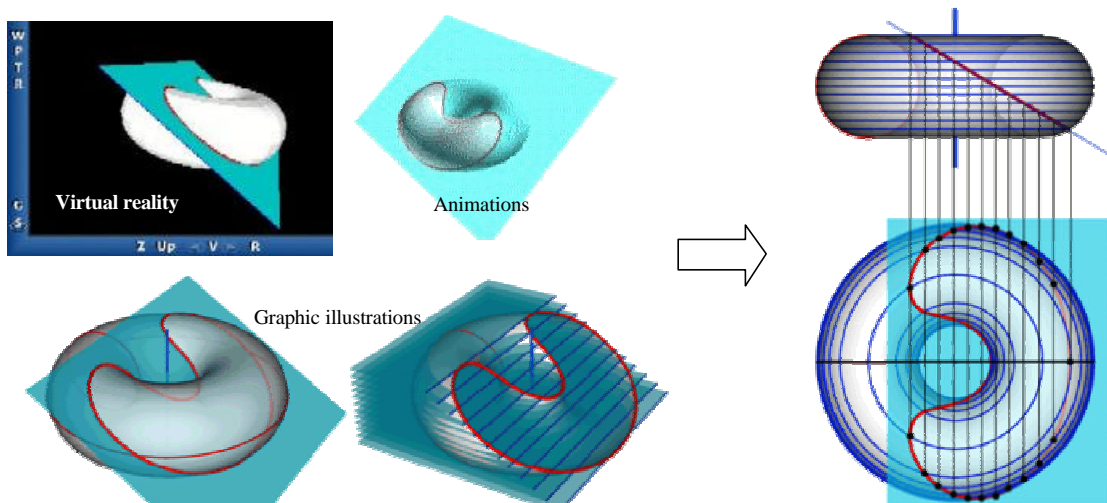


Fig. 3 . The student studies the real object in details and all its properties to understand it representation in projections.

The figure 3 presents in a schematic way as it is made presentation of a certain content. In first place, the student studies the objects through models in virtual reality (with animations or not), animations and illustrations. Only after the student to understand completely the real problem in study in three dimensions, the same situation is presented in orthographic projections.

3. Hypermedia Learning Environment

This new methodological approach was implemented through an atmosphere teaching-learning computational, where models in virtual reality, illustrations, pictures, animations and texts are connected by hyperlinks that allow to navigate for the documents. The hypermedia learning environment uses HTML Help [3] technology and it was created with Microsoft HTML Help Workshop.

HTML Help presents all the advantages of HTML language, as the hypertext use, images, animations, virtual reality (VRML), associated to a system of non linear navigation and to the speed of compiled programs and not interpreted, as is traditional HTML. The non linear navigation is guaranteed by the hypertext and for the navigation bar, that presents all the available topics in a hierarchical way. All this provides to each student, or user, an own individualized way to access the data contained in the electronic document. The HTML Help files are executable and compiled programs where graphic files and animations are built-in in the file of the program (*.chm). The graphic files and animations are compacted to reduce the space in disk. Versions not compiled can be easily created to be access through Internet. In this case, graphic files are not compacted, therefore shall be taken care with the sizes of graphic files used. The use of very big files can make unfeasible the access through Internet, always very slow.

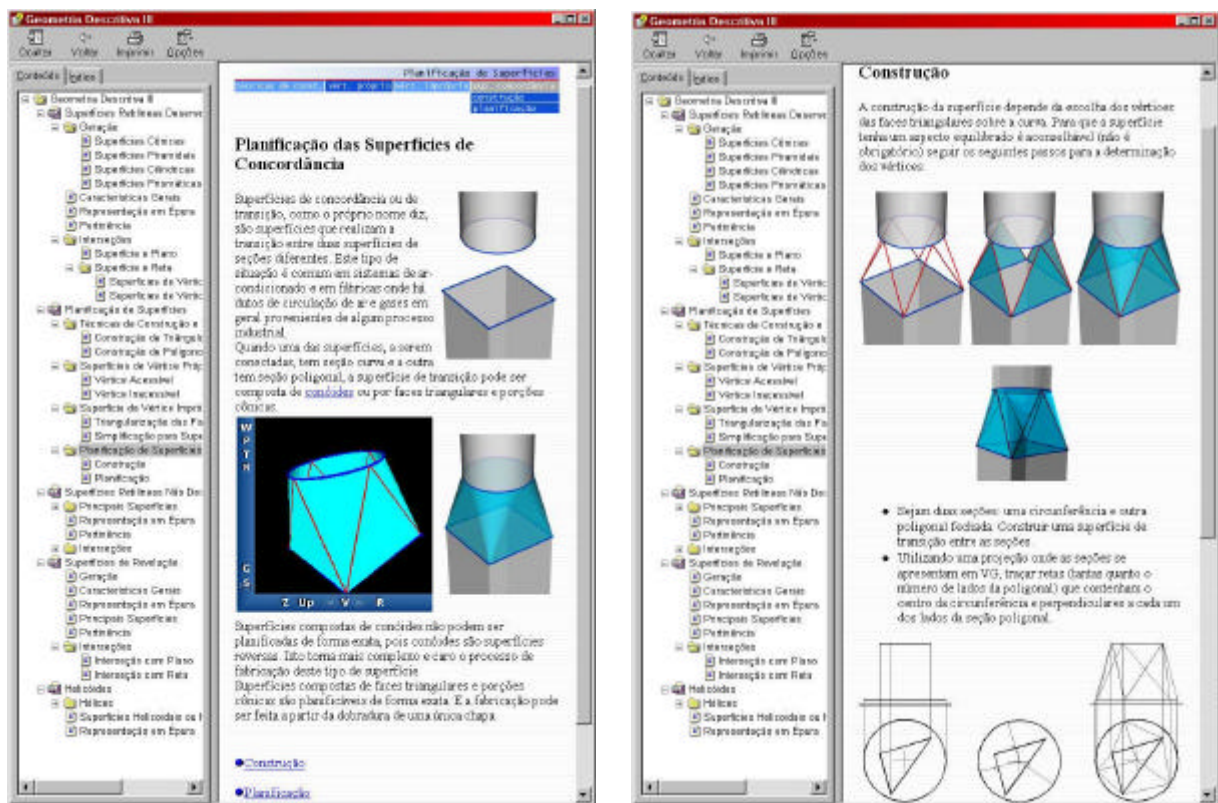


Fig. 4. Aspect of hypermedia learning environment for descriptive geometry.

The figure 4 presents the interface of hypermedia learning environment for descriptive geometry built in HTML Help. A HTML Help standard window contains a menu bar, a toolbar, a navigation bar on left and the content HTML in right.

3.1 Stages of construction of the hypermedia learning environment

The HTML Help uses in Descriptive Geometry teaching began with the transcription of the book that it is still being written by the same team, for the language HTML. The same images were used for both. In this stage, the generated electronic document was not more than an electronic book. The only novelties in relation to the paper version were the non-linear navigation and the capacity of researching words, a very useful mechanism for fast access to information.

In a second stage, animations were created, using 3D Studio Max, from Autodesk, and enclosed to the pages already made. With this, there was an enormous gain in visual quality of the presentation of contents. The animations pattern AVI, generates very big files, even so these files are highly reduced because they are compacted during compilation. In spite of that, the use of a presentation with very “heavy” animations in low end equipment can become very slow and even unviable. In these cases, the problem was solved substituting files AVI, for GIF animated files with less frames than the previous one. The reduction in MB is huge and quality loss in the animations is not significant to the objectives of the project. This technique is also used to create presentations through Internet, where the acting of graphic applications is critical.

In the apprenticeship of current development, the use of virtual reality is being implemented, where interactivity degree is so high that the user can go for a walk among the objects in study. These can have transparencies, textures and materials. The use of virtual reality is made using files in the format VRML, that present great portability and these are the pattern for virtual reality in the Internet.

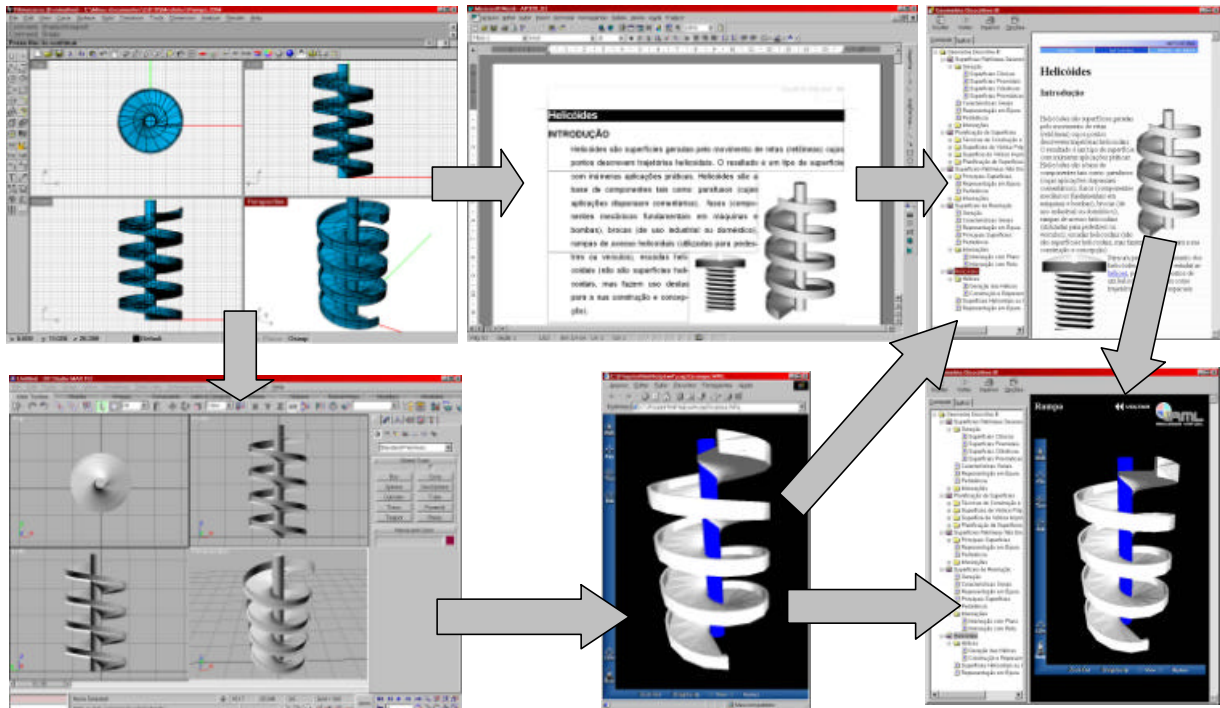


Fig. 5. Stages of construction of the hypermedia learning environment.

4. Conclusion

The interactive three-dimensional experience provided by the countless environment in available virtual reality in this application for Descriptive Geometry, is the great differential for the didactic use. Students have the opportunity to visualize the surfaces and the processes of generation in a such way that learning occurs naturally. This is reflected in the approval levels that have already grown in the first group where the Learning Environment was used.

The use of texts, hypertext, images, animations and virtual reality creates a highly interactive environment that is extremely rich in information, with great potential for use in any knowledge area. The use in Descriptive Geometry comes to supply the great lack of innovations in this such important area of knowledge in basic formation of Engineers and Architects.

5. References

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