

LEARNING OBJECTS AND VIRTUAL REALITY IN TEACHING DESCRIPTIVE GEOMETRY

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Methods and Technologies

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Research Report

Innovative Experiment

Abstract

The present article approaches the development of learning objects in the Computer Graphics Laboratory at the School of Fine Arts at the Federal University of Rio de Janeiro for teaching/learning the discipline of Descriptive Geometry, using the resources of Virtual Reality, in an association among three study groups at UFRJ: the Study Group of Graphic Representation in Virtual Environments - Grupo de Estudos de Representação Gráfica em Ambientes Virtuais at the School of Fine Arts at the Federal University of Rio de Janeiro (GERGAV/ EBA/UFRJ), the Research Laboratory in Information and Communication Technologies - Laboratório de Pesquisa em Tecnologias da Informação e da Comunicação (LATEC/UFRJ) and the Applied Virtual Reality Group- Grupo de Realidade Virtual e Aplicada from the Laboratory for Computational Methods in Engineering - Laboratório de Métodos Computacionais em Engenharia at COPPE /UFRJ (GRVa/LAMCE).

Keywords: Learning Objects, Virtual Reality, Descriptive Geometry

1 Introduction

This paper presents a study involving the development of learning objects at the Computer Graphics Laboratory at the School of Fine Arts at the Federal University of Rio de Janeiro (EBA/UFRJ). Students of the 2nd year of Interior Design, Landscape Design, Scenography, Clothing and Sculpture have developed projects aimed at their respective professional careers. In this way, proficiency until recently restricted to graduate or specialization courses was acquired.

The student should be encouraged to research all of the forms of media, all the sources, in all of the times and spaces, combining the classroom and the on-line. Presentation the results of the study to the professor and colleagues, as well as reporting, comparing, contextualizing, systematizing and delving deeper into them is fundamental. (MORAN, 2004)

2 Learning Objects

“Using the approach of Learning Objects in the construction of digital educational material has even further increased the enthusiasm of both educators and students. The possibility of accessing in the Web greatly advanced reusable resources means a greater savings of time and production costs and, therefore, a greater likelihood of increased offers for extended education.” (NASCIMENTO, 2007, p. 135)

For Leffa (2006), although there is no consensus among the researchers in this area, many studies have highlighted certain characteristics that contribute to a clearer concept of Learning Objects (LO). However, there are as many definitions as there are authors or entities involved, and the concepts seem confusing. Here are some examples:

“Any entity, digital or not, that can be reused in learning, education or training” (IEEE: Institute of Electrical and Electronics Engineers).

“Digital modular resource, individually identified and catalogued, that can be used to support learning” (National Learning Infrastructure Initiative).

“Reusable instruction unit, typically used in electronic learning” (Wikipedia).

“Any digital resource that can be used as a support for learning” (WILEY, 2000).

“Pedagogic document” (ARIADNE: Alliance of Remote Instructional Authoring and Distribution Networks for Europe).

“Component of educational software” (ESCOT: Educational Software Components of Tomorrow).

“Online learning material” (MERLOT: Multimedia Educational Resource for Learning and On-Line Teaching).

“A small learning unit” (Wisconsin Online Resource Center).

“Resource.” (Apple Learning Interchange).

(LEFFA, 2006. p. 4)

Gazzoni et al (2006) considers the expression Learning Objects as didactic digital material, having the characteristic of being able to store and then reuse. It is always structured by content to be learned, in other words, by a curricular unit or any didactic material, a lesson, by class, course or training program content,.

Leffa (2006) suggests that a good example of LO would be that offered by the Program of Extended Education at the University of Wisconsin (Wisc-Online):

“A small unit of electronic data characterized as being flexible, reusable, customized, inter-operable, recoverable and able to facilitating learning based on capability and increase content value”. (University of Wisconsin-Extension)

For Filho et al (2004, apud Teixeira, 2008), the “Learning Objects can be described as any resource used to support the learning process”. Sá and Machado (2004, apud Teixeira, 2008) complement this by saying that they are “digital resources, that can be used, reused and combined with other objects to form a rich and flexible learning environment”.

However, the most complete definition of LO is found in the studies by Vaz:

“Learning object is any digital entity with educational objectives used by a DL application. It is characterized by meta-data which facilitate indexing, recovery and reuse of the LOs. The LOs can include any media, of various sizes and formats (for example, video or radio), flash animation, a simple digital component or a complete Web site“ (VAZ, 2009. p. 387).

Gazzoni et al, (2006) shows us that the IEEE (Institute of Electronic Engineers) and IMS (Instructional Management System) consider the following characteristics as common to all Learning Objects:

Reusable: permits that the LOs can be used in different manners, as basic modules, to work different contents in different contexts;

Portability: the capacity of an object to be executed at different work platforms;

Modularity: refers to the LO form, which should be independent modules, and not sequential, so that they can be used together with other resources and in different contexts. An LO is part of a complete course, which can contain other learning objects or be contained in one or more objects or in one or more courses;

Metadata: a complete description of the attributes of the object that will be catalogued, obeying the indexing, research and object recovery standards, making it understandable for the various platforms. The information is: title, author, date, publication, keywords, description, objectives, characteristics that indicate how, when and by whom the object was developed, stored and how it is formatted. The most common meta-data standards are: Learning Object Metadata (LOM) of the IEEE and the Sharable Content Object Reference;

Interactivity: is one of the most important characteristics, as it refers to the interaction of the student with the object. The interaction can be active or not, according to the concept of the object.

Besides the above-mentioned characteristics, the Learning Objects should also have the following attributes:

Flexibility: they are built in modules that have a beginning, middle and end, however, are flexible and can be reused without maintenance;

Facility for updating: as all data, relative to the object, are located in the same Data Bank, the updating performed via corrections and improvements is simple;

Customization: as all objects are independent, they can be used in distinct courses (under-grad, specialization or any other type of course);

Interoperability: storing of LOs is standard. The reuse of the objects not only on the level of teaching platform, but on an international level;

Increase teaching quality: the LO can be reused many times in many courses. With this, its consolidation grows and significantly improves the quality of teaching;

Indexing and search: standardization of objects also aims to facilitate the search for a determinate object in any bank of objects that is available.

According to Falkembach (2005, apud Gazzoni, 2006), the process of concept and development of an LO includes the planning, modeling, installment and distribution. Planning involves choosing the theme to be worked and should answer some questions, such as: what is the objective of the Learning Object? What public is it targeted for? How will the content be presented? When and how will the object be used? How will the student interact with the object? What results are expected?

Similarly, Nascimento (2009) states that a critical analysis of the team producing the learning objects, with relation to the pedagogic planning of these materials and in relation to the use of the technology is necessary. As the following text indicates:

“Upon composing a learning object, it is fundamental that the teams recognize the importance of combining knowledge in the specific area of the disciplinary content with knowledge about the principles of the learning process.” (NASCIMENTO, 2009, p.136)

3 Virtual Reality

Tori & Kirner (2006) adopted the following definition of Virtual Reality (VR):

“ Virtual Reality is, before all else, an ‘advanced user interface’ to access applications executed in the computer, having the characteristics of visualization of, and movement in, tri-

dimensional real-time environments and the interaction with elements of this environment. Besides this visualization, the experience of the VR user can be enriched by stimulation of the other senses, such as touching and hearing". (TORI & KIRNER, 2006, p.6)

In the 80's, VR equipment began to be commercialized, such as helmets (HMD - Head Mounted Displays) and Gloves with force feedback (which allow to feel and touch virtual objects). Initially, VR aimed to simulate flights for the military industry. Its application was extended to the most varied fields: academic and industrial research, then simulating prototypes for the automobile, naval and aerospace industries as well as in medicine for tele-surgery and the entertainment industry, with 3D games. (GEOCITIES, 2009)

VR can be divided into immersive and non-immersive. It is called immersive when it is based upon the use of helmets and gloves. It is non-immersive when the PC monitor is used for the simulation. (Idem, 2009). For Distance Education, non-immersive VR has become a viable tool with the development of VRML -Virtual Reality Modeling Language. VRML is free and uses open code, created to be used on the Internet, and thereby justifying its great potential for educational applications. As Marins defends:

"With VRML it is possible to construct Internet sites, with interactive tri-dimensional objects that can be linked to text, audio, video files or even to other VRML sites and worlds". (MARINS et al., 2007, p.3)

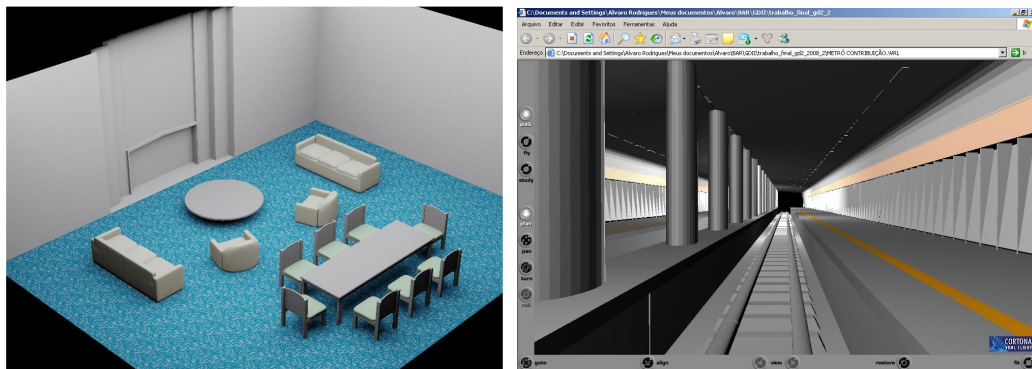
4 The Development of Learning Objects at UFRJ Computer Graphics Laboratory

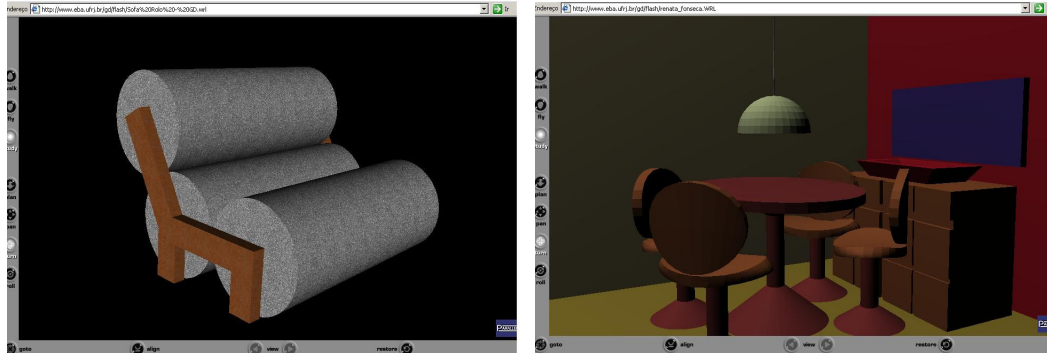
"It is difficult to construct a good simulation LO without a development team that includes: teachers with the domain of the explored area of knowledge, teachers or students having experience with production tools and knowledge of the potential of the technology, as well as a professional with knowledge about the learning processes and cognitive principles." (NASCIMENTO, 2009, p. 138)

The Study Group of Graphic Representation in Virtual Environments (GERGAV) initiated, at the Computer Graphics Laboratory (CGL) – at the School of Fine Arts at the UFRJ, the creation of tri-dimensional models, in association with LATEC/UFRJ, at the School of Communication and LAMCE, at COPPE (Alberto Luiz Coimbra Institute Graduate School and Research in Engineering).

The models developed in the VRML language were generated by the 3D Studio Max software and exported for download by the Internet. They can be moved, bring near, send further apart and rotated according to the user's wishes (Figures 1, 2, 3 and 4). The visualization of the tri-dimensional models can be accomplished on any computer upon the installation of a VRML visualization and navigation plugin. In the case of this project, Cortona, developed by Parallel/Graphics, was used in this project.

The objects developed are available at *Galeria* - Gallery in the section *Tópicos* - Subjects at - *Portal Espaço GD*- DG Space Portal available at: (www.eba.ufrj.br/gd/galeria.htm). It is here that the content is available to all those interested, acting as a *repository*. (cf. Nascimento, 2009; Leffa, 2006). (<http://www.parallelgraphics.com/products/cortona>). (Lima et al 2007, p. 9)





Figures 1, 2, 3 and 4. Four examples of Learning Objects created by undergraduated students during the course.

5 Final Considerations

The learning objects created in the CGL aim to diversify the classes of the discipline being taught and are not meant to serve as the sole form of teaching. Thus, the presence of a skilled professor is fundamental for the correct use of the LOs and for student support. The students were not restricted to only modeling the geometric surfaces, but they were also stimulated to idealize projects according to their professional careers.

This experiment has demonstrated that the concept of learning objects and the process of installing them can assist greatly in the educational process and in the development of new courses and educational materials, all of which aim to make teaching and learning of Descriptive Geometry, or any other discipline, easier .

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