

NEW INFORMATION AND COMMUNICATION TECHNOLOGIES FOR THE TEACHING OF COMPUTER GRAPHIC DESIGN

G. DEL RIO -CIDONCHA, J. MARTINEZ-PALACIOS, AND E. MARTINEZ-LOMAS

Department of Engineering Graphic, University of Seville

Avda. de los Descubrimientos s/n, 41092, Seville (Spain)

e-mail: cidoncha@esi.us.es

Abstract

Within the computer aided design (CAD) teaching framework, new information and communication technologies (ICT's) are being set through new tools and methodological changes: multimedia applications in different formats and mediums, specific software packages, virtual lecture rooms and campus, internet and its different resources, e-mail, etc. The aim of this article is to build a bridge between the current conception of the CAD subject, in our Advanced Engineering School (AES) of Seville (Spain), and a multimedia course by using the current state of the art ICT's. This multimedia course has been proposed as a future subject. These technologies are to be used in two aspects. On one hand to make use of the communication potential that the internet has and develop a multimedia course for CAD training. On the other hand, substitute Solid Edge graphic software for Computer Aided Three Dimensional Interactive Application (CATIA) which, nowadays, is very popular for modelling solids in companies. Besides the development of the webpage, a detailed study of the installation and operation of an interactive lecture room will be shown, involving computers with access to the internet, including all of the necessary hardware and software.

Keywords

E-learning, Internet, Modelling solids

1. Introduction

The multimedia course that has been developed offers an alternative, to the practical part, of the computer graphic design subject in the third year of the Industrial Engineering degree at the Advanced Engineering School of Seville. The software that is used during the training is Solid Edge. This is a medium of the range computer aided design programme (CAD), which has now been overshadowed by more advanced programmes that include and widen their features. This programme is therefore now just practised in universities.

This article aims to take a step further into the development and innovation of teaching, using contemporary instruments, which develops the necessary skills in our students. The permission to implement new information and communication technologies (ICT's) in the teaching of CAD has been applied for, as well as a change in Software, to one that is top of the range and more widely used in the market: Computer Aided Three Dimensional Interactive Application (CATIA).

The use of ICT's in the teaching – learning process allows the student as well as the teacher to overcome the time and space constraints which are present in traditional teaching. A world which is accessible from the Web has been developed, which is very

versatile, as it works through a server which is connected to a local network. This can also be done individually by running the application from a CD-ROM in the lecture room or home. The aim is to create a place in the network that eases access to information needed by users and the possibility of sharing knowledge.

CATIA creates many advantages for companies. It is also easy to use which means the course is simple, so the student can benefit from advanced training in a short space of time. The student can use a top of the range programme, leader in its field which provides new solutions to design and manufacturing.

2. Current e-learning situation: the teaching of CAD on the internet

The advances that are being produced on the internet, referring to hardware and software and the fact that the internet is now a means of communication for society, both in the workplace and home, have meant that it is considered as one of the training instruments with the most possibilities for the immediate future [1].

Internet-based training can be defined as a training mode, where the transfer, exchange and storage of information can be carried out through computers connected to the Internet or Intranet.

Information and communication technologies offer a lot of advantages which can be applied to teaching: the possibility of creating communication multimedia environments, the ability to overcome the space-time limitations of attendance-based training, the facilitation of students being converted into information creators, the creation of an environment where information is conveyed non-prescriptively allowing the student to choose his/her own path according to what interests him/her, the creation of interactivity between system users, the immediate update of information and the preference to create collaborative environments for learning [2].

CAD applications have always been pioneers in the progress of the most advanced information technology. The spreading of CAD design tools to various production sectors causes huge training demands at different levels. One of those, as in this case, is universities. Due to the speed of evolution in technology and languages, a complete and updated training cannot be given. Therefore, the student must be given a flexible approach to personal learning [3] and the fundamental and necessary information about these technologies and languages.

3. Subject organisation and logistics

A project is presented about a CATIA lecture room [4], which involves computers connected to a network. The objectives of this will be to run the developed CATIA multimedia course and establish communication areas that provide interactive learning between students as well as between teacher and students.

3.1 Training room. Necessary materials

A network connected within a limited area, which is required for this project, is known as local area network (LAN). A LAN is often housed at a single location where information is exchanged by computers or resources, allowing the sharing of it. The sharing of information could be contained in the disk, printer or modem [5].

To be able to create a lecture room using a local network (LAN) one has to install a series of equipment that allows the following:

- Treatment and visualisation of data generated by CATIA in the machines.
- Sharing of all information.

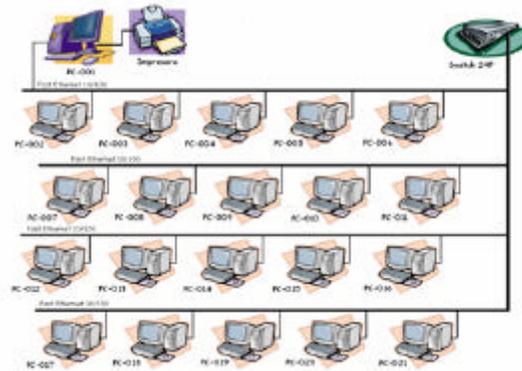


Fig. 1. Network configuration sketch

Once the different equipment needed for network configuration has been studied and chosen, a sketch of twenty-one computers is drawn, including the teacher's computer (see figure 1). It is important to point out that the technical characteristics, of both the computers and monitors, are set according to the hardware needs of the CATIA application. A breakdown of the equipment is shown as well as a sketch of the network configuration of the room:

--Twenty-one Pentium IV computers with the following technical characteristics:

- 2.8 GHz Pentium IV processor.
- 256 Mb RAM memory – 266 MHz DDR PC2100.
- 40 GB Hard disk, 7.200 rpm.
- CD-ROM/DVD player
- AGP Nvidia GeForce 4 Mx440 128 Mb graphic card.
- 10/100 Fast Ethernet network card.
- PS/2 keyboard
- 3 button PS/2 mouse

--Twenty-one CRT 19" monitors - 16.7 million colours

--A 24-port 10/100 Fast Ethernet switch.

--A printer.

--One hundred metres of category 5 (STP) multifilar cable.

--Forty two RJ45 (STP) connectors.

3.2 Communication area

A communication area is essential in a course like this. One must reserve, within the internal network of the training room, whether it is in the server or a more powerful computer, a space in order to generate an internal forum for course attendees. In this

forum students can ask questions and resolve problems amongst themselves or with help from teachers. Also, thanks to network configuration and the possibility of connecting this to an external network, students can access other forms of communication such as e-mail, chat and external forums.

On the other hand, by using the CATIA tool, Conferencing [6], the teacher from his/her computer can show all students the documents and actions and they can follow the exercise from their computers.

Conferencing is a CATIA tool that allows two or more users of a network to communicate by viewing the same on-line graphic environment, mouse pointer and screen changes. This tool is very convenient when it comes to giving a lecture in a networked lecture room. This is a remote control tool in a CATIA framework.

3.3 Software requirements

The following is necessary:

- Windows 2000 or XP: to be able to install CATIA.
- Internet Explorer (version 5.0 or higher): with this programme one can surf the different pages contained in the Web.
- Windows Media Player: the page runs this programme automatically in order to watch videos.
- Acrobat Reader: the page offers us the possibility of downloading the different sections of the lectures, in PDF format.
- CATIA: this software is not strictly necessary for the visualisation of the page. However, the aim is to complete exercises by consulting the net at the same time.
- NetMeeting: this is a very useful programme as it allows communication between students and lecturers (Chat). It is also needed for the Conferencing CATIA tool. This software is supplied with Windows.
- Course: this has been devised as a webpage to give it more dynamism.

4. Course

This course involves five lectures and covers 2D design as well as the modelling of solids and complex surfaces. Each of the lectures is divided into five sections:

- Objectives: a brief summary of the goals to be achieved by the end of the lecture.
- Fundamental theories: theories are given for each lecture.
- Practical development: step by step resolution of various exercises, applying knowledge acquired in the previous section. These exercises will get more difficult as the course continues.
- Proposed exercises: an exercise will be given for students to solve.
- Video: the solution to the exercise from the above section will be shown in video format.

In both practical development and proposed exercises, a link to the CATIA document will be shown at the end. This way the students can see the solved exercise and compare it to their results, as well as visualising the model specifications tree.

4.1 Course contents

The course involves five lectures which will include the following:

1) *Introduction to Catia and reference elements*

This subject has two objectives: Firstly, to familiarise the student with the CATIA environment. Learn all that is necessary to be able to start working with this programme: open a session, get to know the different files and modules, use the mouse and generally get to know its environment. Secondly, start learning the programme by getting to know the reference elements: point, line, plane and axis systems. These are very useful for designing.

2) *Sketcher (2D Design)*

Sketcher is a 2D design module that allows the creation of geometries and profiles needed to construct solids. It also helps one to work with them to create or modify relationships between geometric elements. Once the geometry has been created, geometric and dimensional restrictions are established, through the application of constraints.

3) *Part Design I (3D Design)*

The tools used for generating solids in a simple way are shown. The information will be stored in Parts, documents that contain all geometrical information about the solid. The lecture is divided into two parts: the generation of basic shapes and the modification of these.

4) *Wireframe and Surface Design*

The generation of wire geometries and basic surfaces will be studied. Wire geometry is just reference elements (already seen) and curves that serve as guides or limits to generate the surfaces. To develop these concepts, one must go to the Wireframe and Surface Design module, within the Mechanical Design section.

5) *Part Design II (Advanced 3D Design)*

This covers the rest of the icons under the Part Design module as well as their uses. Hybrid modelling is also studied: generation of solids from surfaces, Boolean operations with solids, transformation operations, application of materials and analysis of its properties.

4.2 User Guide

This is to help the student with the CATIA course. It has been created in HTML format because of the advantages that surfing Internet Explorer offers, making the course easy and intuitive.

1) *Sections and lectures menu*

The sections and lectures menu is used to access the different lectures or to access the different sections of a lecture.

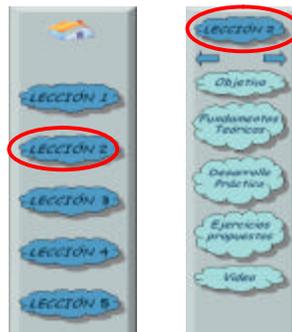


Fig. 2. Bars for the lectures and sections menus

By clicking on these icons, the page of the corresponding lecture will open. In Figure 2 one can see how the lecture menu changes to the section of the lecture menu.

2) *A glance at a lecture*

The multimedia character structures the contents hierarchically. To make personal surfing easier, more convenient, controlled and learning-orientated the place where the student is surfing is always shown.

These theoretical pages are rich in hypertext as observed in figure 3. Commands given by Internet Explorer are necessary when surfing.



Fig. 3. Page with links

3) *Utilities*

Such as the following:

--Downloading of CATIA files: during the explanation of an exercise, solved in the Practical Development section, the student has the possibility of downloading a CATIA file so that it can be run on his/her computer to be able to see the operations that were carried out in the exercise.

--Video reproduction: this multimedia course offers the possibility of reproducing videos using the Windows application: Windows Media Player. The videos give a step by step description of the procedures to follow to obtain the solution to the exercises proposed in this section. This way the student has the possibility of following the solution to the exercise without losing any details of the operations carried out because he/she can stop the video reproduction, rewind it, enlarge it, etc.

4) *Main menu*

The main menu is found at the top of the page and is the same one in all lectures (see figure 4.) The different icons that appear in this menu are shown below:



Fig. 4. Page with links

--Initial page: If one presses this icon, the computer will directly return to the initial page of the course.

--Print: This icon prints the section that is open.

--PDF: By clicking on this icon, one is linked to a new page: It is a different webpage but with the same structure. One can access any part of it and download it in PDF.

--Direct access to the Advanced Engineering School (AES) of Seville webpage.

5. Conclusion

Adapting traditional teaching methods to state of the art technologies known as ICT's is a necessity as well as a challenge for lecturers [7]. This is due to the need to encourage students to gain knowledge about them (although this is not the specific objective in Graphic Engineering) and also due to the versatility and flexibility that its use has on the teaching of CAD (which is shown in this article) as well as in other knowledge areas.

This flexibility covers two aspects: the necessary contents and logistics needed for training. With regards to the latter it is evident that distance education, which is not subject to time constraints and physical location, is becoming more and more relevant. ICT's are aimed primarily at achieving this goal. Logistics is also helped by the general use of internet and the proliferation of personal computers. On the other hand, ever increasing speed and changes in technology, particularly in graphic technology (which is our field) forces everyone to use resources that ease flexibility and updating of data, according to society demands.

However, technology alone does not have any magic effects [8]. New roles and competencies are needed for university teaching to be able to respond better to the challenges faced by a society of knowledge [9]. A teacher, knowledge professional, learning-environment designer is required with the ability to make optimum use of the different educational spaces available [10].

This article is a clear example, used practically, of the use of ICT's and new methodologies that are to be clearly imposed in the very near future in the teaching of Graphic Engineering due to the convergence of the European Area of Advanced Education.

References

- [1] J. I. Aguaded, J. Cabero, *Educar en Red. Internet como recurso para la educación*, Malaga: Ed. Aljibe, 2002
- [2] J. Cabero, *Las TICs en la Universidad*, Sevilla: Ed. MAD, 2002
- [3] M. Zapata, "Internet y educación," *Revista Contextos de Educación*, vol. 2, pp. 27-43, 1998
- [4] M.G. Rfo Cidoncha, J.Martinez Palacios, M.E. Martinez Lomas and S. Perez Diaz, *Diseño Avanzado con CATIA V5: Aplicaciones prácticas de Sketcher, Part Design, Wireframe & Surface Design, Assembly Design y Drafting*, Madrid: Ed. Tébar, 2006
- [5] J.C. Torresano, *Curso de redes básico*, C.P.R. de Hortaleza II, 2004 [Online].Available: <http://www.abcdatos.com/tutoriales/tutorial/z2761.html>
- [6] F. Karam, C. Kleismit, *Using Catia V5*, Canada: Delmar Learning, 2004

- [7] M. Area, "Del MSDOS a Internet", *Aula de Innovación Educativa*, no. 135, pp.30-34, 2004. Available: <http://webpages.ull.es/users/manarea/biblioteca.htm>
- [8] J. Hill, M. Hannafin, "Teaching and Learning in digital environments: The resurgence of resource-based learning.". *Educational Technology Research and Development*, vol. 49, no. 3, pp. 37-52, 2001
- [9] A. Sangrá, M. González, "El profesorado universitario y las TIC: redefinir roles y competencias," in *La transformación de las universidades a través de las TIC: discursos y prácticas*, A. Sangrá and M. González, Barcelona: Ed. UOC, pp. 73-97, 2004
- [10] C. Marcelo, "Aprender a enseñar para la sociedad del conocimiento", *Educational Policy Analysis Archives*, vol. 10, no. 30, August 2002. Available: <http://epaa.asu.edu/epaa/v10n35/>