

The Construction of a Virtual Learning Environment in Fluid Mechanics in an Undergraduate school

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ABSTRACT: *The technologies of information and communication have shown as a global trend in the most different sectors of the society of the world today. Not being able alien to such movements, the university's environment follows such changes in order to give account of a public with great intimacy with these technologies. This work presents and argues the stages of construction's project of a virtual environment of learning in Fluid Mechanics, discipline that it integrates the curricula of chemical engineering in the Pontifical University Catholic of the Rio Grande Do Sul (PUCRS). The considered environment searches to privilege the interactivity, cooperation and autonomy of the students. Anchored in a platform that makes use of the manager software, Web-CT, and video conference, hypertexts, virtual laboratories, forum and chats are created. These activities are programmed in order to mix with the traditional activities in the graduation course. In this way, we intend to make use of a richer environment of possibilities, which stimulates the interest of the student come to promoting significant learning processes. In this work we also debate important questions relative to construction an environment of quality learning and how to make professor and students participate in this process by cooperative and creative form.*

1 INTRODUCTION

The graduation in Chemical Engineering, with emphasis in Petrochemical Operation (offered at distance) is based on a project established as a partnership with Braskem SA, formerly OPP Química SA, a most relevant petrochemical company in South America. The main objective of this proposal is to qualify professionals for the market, since this is a course designed to professionals without a superior that are currently developing activities as operators of industrial processes. So, the elaboration of a curricular structure supported by a pedagogical approach that is adequate to the purposes and inherent characteristics of the course was towards the limitation of presential activities to 25% of the period, and the remaining activities must be developed at distance [Medeiros et al, 2001].

The incorporation of information and communication technologies in the educational environment has made possible that cooperative actions were developed, towards the individual and collective growth, as well as improving the subject's initiative, flexibility and autonomy. Under this perspective and praxis, differently from the previous innovations, the nature of such changes affects not only the teacher, but also the student and their environment.

There's no doubt that it's necessary to form teachers to act creatively and to adopt the technologies as allied to them. It's needed to re-think the teacher's commitment in front of this new context, to consider on the importance of investing and base the teaching on learning theories for a contemporaneous education, as well as to learn how to apply computer tools in online Education. This new teaching involves the knowledge of tools, services, methods and motivating strategies that induce the teacher to reflect on its role inside these new learning organizations. In this context it's described the construction of a learning environment in Fluid Mechanics for an undergraduate course in Chemical Engineering, [Vargas et al, 2003].

2 STRUCTURE OF THE FLUID MECHANICS DISCIPLINE

The course was structured according to the topology (technological arrange or organization) of the media contemplated at PUCRS VIRTUAL. The used resources included videoconference mediated by satellite segment, remote access to the classes by video on demand, use of resources, services and tools from the Web, besides toll-free (0800 telephone numbers) and other conventional telephone lines that were made available to contact with teachers and teaching assistants. The course considered a priority to attend to the following features: accessibility – the possibility of student’s access; addressability - condition of reaching places and people, considering the difficulties of transmission and reception of data and images exclusively via the Internet; resolutivity - the ability of simultaneously to transfer and to receive data, images and sounds with quality and speed; interactivity, permanence, transparency, sharing and terminality [Medeiros and Medeiros, 2001].

In the course’s organization, two weekly hours were assigned to a videoconference or a presential class and other two hours were destined to oriented works, via the Web environment. To support the student’s learning, an internet website for the course was designed and built, to act as a reference, as a meeting point to all the participants. This page was organized with two structures: one open, the other closed. The open part, visible to all the internet users, lists general information on the course, as the faculty, directory, chronogram, disciplines, and others.

The image shows two screenshots of the Engenharia Química website. The top screenshot shows the main navigation menu with an 'Área exclusiva aos alunos e professores do curso' (Area exclusive to students and course professors) highlighted in orange. A green arrow points from this area to the bottom screenshot. The bottom screenshot shows the 'Disciplinas' (Disciplines) table, with the 'Fenômenos de Transporte' course highlighted in orange.

Nível	Disciplinas	Versão
I	Estequiometria Industrial	2000/2 2002/2
	Matemática Fundamental	2000/2
	Metodologia Científica	2000/2
	Química Geral	2000/2
	Química Orgânica I	2000/2
II	Cálculo Diferencial e Integral I	2001/1
	Física Geral e Experimental I	2001/1
	Língua Inglesa I	2001/1
	Química Orgânica II	2001/1
III	Álgebra Linear e Geometria Analítica	2002/1
	Estratégia Empresarial	2002/1
IV	Física Geral e Experimental IV	2001/2
	Física Geral e Experimental III	2001/2
V	Física Geral e Experimental II	2002/2
	Fenômenos de Transporte	2002/1
VI	Química Analítica II	2002/1
	Cálculo Multivariável II	2002/1

Figure 1- Course’s website: Open Part

The closed part is an area exclusive to the discipline’s participants, created in the WebCT¹ management environment, where the access is restricted, by a password, to the course’s users only. It’s relevant to say that this environment was extended to the students from the presential-only course. All materials, communication tools (e-mail, chat, forum), evaluations, tools for download, online classes and the archives of chats and previous classes are contained in the manager, as can be seen in the figure 2.

¹ WebCT is a manager of learning at distance, developed at the University of British Columbia and utilized by over 1500 institutions in 61 countries.

The environment's organization attended to the demands for interactivity, collaboration, autonomy, meta-cognition and affection, privileged by the PUCRS VIRTUAL's paradigm [Medeiros et al, 2001.a]. The management and storage of didactic material permitted to the teacher to upload files with different extensions (*.ppt, *.pdf, *.doc, *.avi, etc.) to the environment [Wagner et al., 2003].

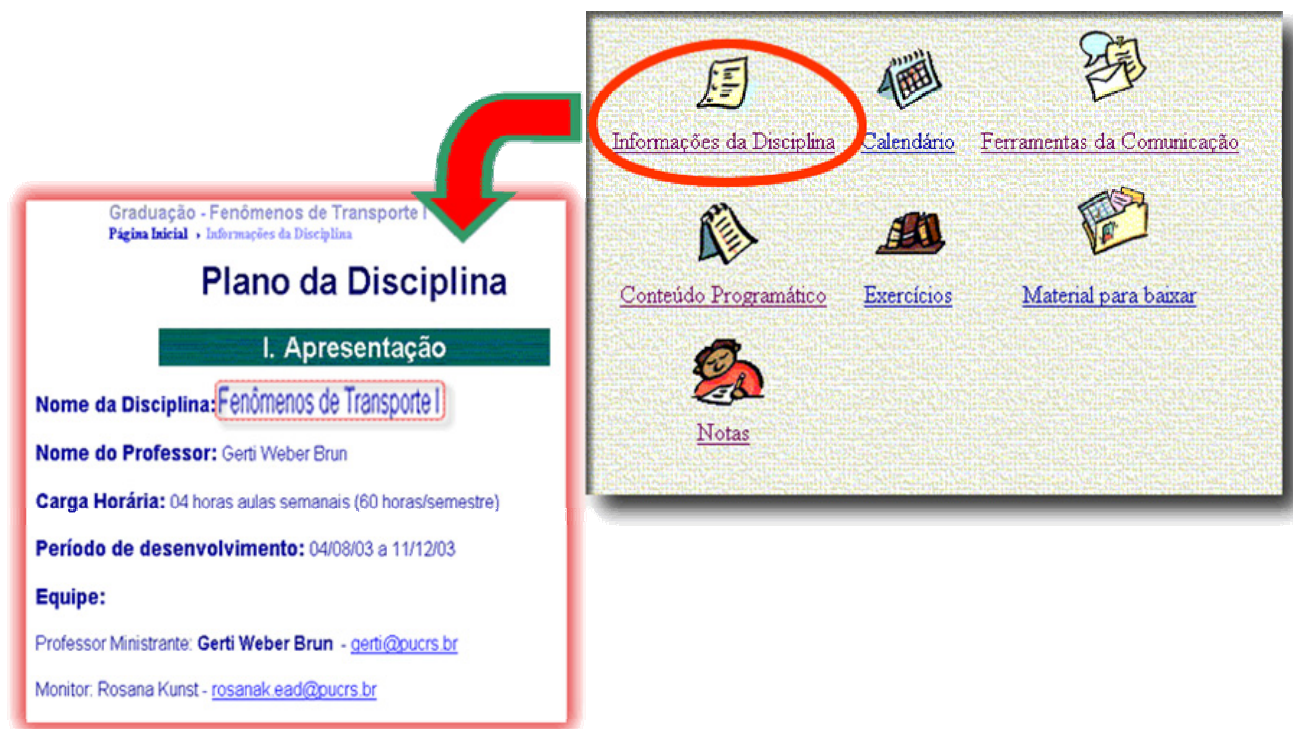


Figure 2-Course's environment: Closed Part

The students' monitoring facilitated by the WebCT makes possible to acquire varied information, as: number of connections per student, data of the first and the last access, as well as the materials accessed by each student; the qualitative analysis of the speech in chats and discussion forums is also possible. Such conditions make possible to monitor the learning process, permitting a constant evaluation of the interest for the tasks and the student's possibilities and impossibilities, so that the docent can be alerted to change routes and strategies to promote an effective learning.

The evaluation process is concreted by presential examinations, besides an evaluation that will occur along the process, from the permanent accompaniment of each student's individual performance (by the teacher), manifested in the course's environment. Although the system can be considered as a surveillance or control politics, by its characteristics, this accompaniment is understood as a monitoring that will cause another procedures and will attend to the individual needs in the learning process. It's important that the teacher possesses other strategies to attend to the unusual demands that can appear from each subject.

The accompaniment made by the teaching staff (teacher and assistants) regarding to the tasks developed by the participants has been oriented to respect the student's manifestation, in a relation eminently dynamic, participative and guided by the dialogue, to favor that dimensions as interactivity and cooperation come to reunite to the cognitive process, in a collective and individual level.

The discipline was structured in eight modules, presented in the Table 1, and the total predicted schedule of 60 hours in one semester would be accomplished partially in the presential mode, according to the activity's nature (laboratory activities and evaluation exercises), the remaining time would be dedicated to activities developed at distance, involving communication and navigation tools in hypertext materials.

Table 1: General view of the discipline's modules

Unit I	Basic Concepts
Unit II	Fluid's Statics
Unit III	Global Mass Balance
Unit IV	Global Momentum Balance
Unit V	Global Energy Balance
Unit VI	Flow Differential Analysis
Unit VII	Dimension Analysis and Similarity
Unit VIII	Viscous Flow

The monitors are selected from the students of Chemical Engineering and give support to the teacher in the construction and organization of learning environments and classes, interacting with the student regarding to the discipline's contents and responding to the students' technical difficulties. It's a moment of mutual learning, in which teachers and monitors, with their specificities, differences and conflicts, dialog to keep the dynamic stability of the pedagogical processes in the virtual learning environments. It's the asymmetry expressed in the symmetry of speech and actions [Habermas, 1990].

4 LEARNING TOOLS

The communication tools (electronic mail, discussion forum and chat) become potent learning tools when they permit that the students know each other, to expose their ideas, to exchange information, establishing a cooperative posture and interacting with the colleagues, the teachers and the monitors, besides the materials and the technology itself, regardless the distance.

The chat, as a synchronous tool, is offered in a number of hours, as requested by the students and is about a predetermined topic. As the WebCT permits to save the chat sessions, these records can be retrieved and put in the course's webpage, so the students can accompany a posteriori. The teacher's role is to articulate and to mediate the work, motivating and complementing the topics presented during the chats, forums and in other moments in the course, to incentive the development of autonomy and collaboration among its pupils.

The forum is a tool for asynchronous discussion and permits that either teachers and students post messages related to the thematic proposal. It also permits that instigating questions to be suggested to generate future forums. In this type of environment, as in the chats, the exchange of experiences and the exposition of different points of view favor the exercise of citizenship, as well as the experience of the aspects that refer to the multiplicity and the conviviality in the diversity.

Another didactic resource employed in the course's environment is made by hypertexts. This material has as main characteristic the possibility to accede to different pages published on the web, as well as to links to previously studied courses, to review already-seen contents, promoting the integration of knowledge that's a goal of the pedagogical project.

The use of hypertext is based on and results in the favoring of the multiple intelligences and, as a consequence, of the multiple ways of learning, as presented by Gardner. The material hosted in the web, under a mutant form, easily privileges the multiplicity, not only in the rizomatic sense pointed by Deleuze and Guattari but also in the direction pointed by Edgar Morin with the complexity paradigm [Pernigotti, 2003]. An example of a hypertext is presented in the figure 3.

The classes developed as videoconferences are recorded and later made available to the students as a CD-ROM. The class employs resources as Power Point and filmed experiences, in addition to the document's camera, where tables, figures and the step-by-step solution of exercises. The use of different media points to the students notices a certain subject using several senses and the individual capacities of intelligence are developed, contemplating the different forms of learning.

The use of animations, figures, texts interconnected to hypertexts used as agents in the learning processes, among the videoconferences and the interventions with the communication tools presented above, has enriched the learning environment constructed with multiplicity.

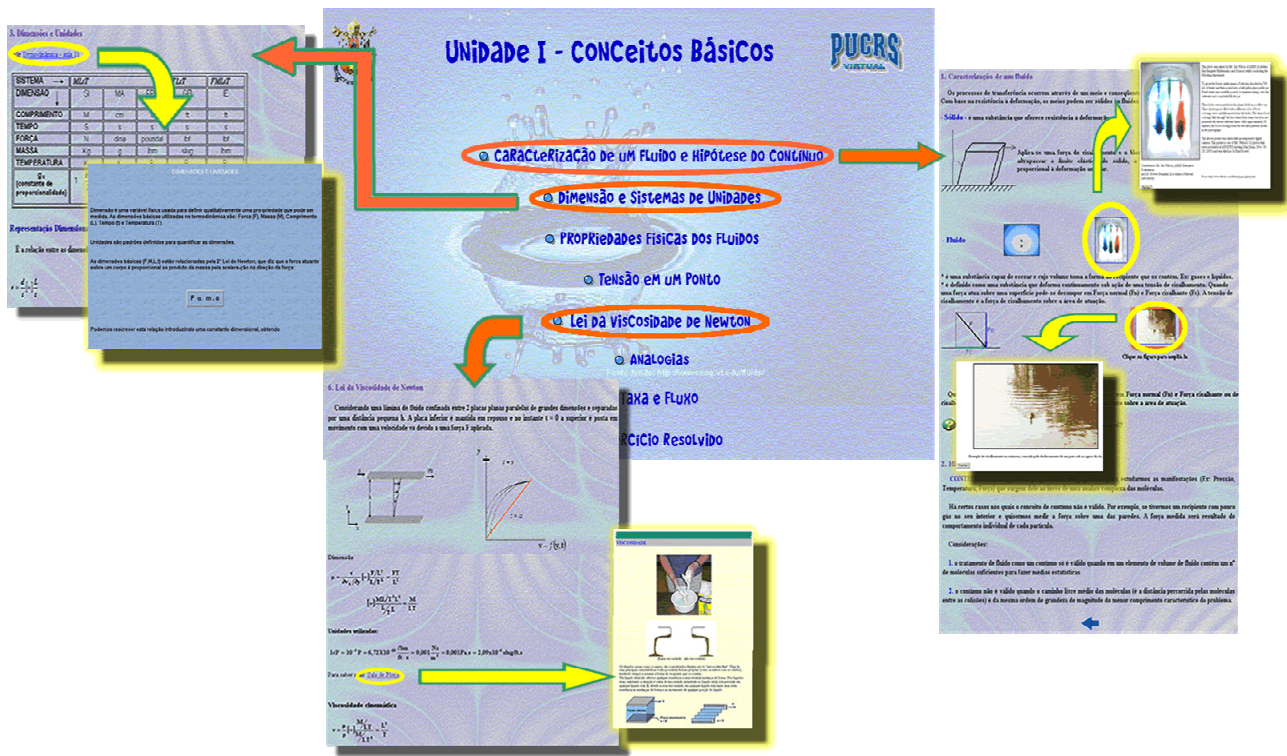


Figure 3-Example of Hypertext

5 FINAL CONSIDERATIONS

The construction of this learning environment, strongly supported on the use of technologies, isn't apart from the already traditional educational procedures, regarding the effective production of learning, i.e., the technology alone won't guarantee a rich and instigating (and, by extension, proper to the learning) environment. The commitment of the several actors in the process is a determinant in this kind of environment and even with all the technology, a considerable amount of human resources is involved [Medeiros et al., 2002].

One can say that one of the challenges posed by the DE paradigm is the virtual's processualization. Above all, it's tried to guarantee that this process constitutes the entrance to a virtual culture and that it be, by its own flexible and instigating nature, open to the continuous transformations that occur and propagate in the Education at Distance. [Deleuze, 1999],[Deleuze and Guattari, 1995, 1997], [Alliez, 1994].

The virtual environment assembled to the discipline of Fluid's Mechanics here presented tried to supply an imperious and challenger demand posed to everyone that acts like a teacher, in the need to attend a public extremely familiar to the use of communication networks. The new generations are extremely autonomous and to behavior as passive receptors of information violates their nature.

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