Chapter XV

Project-Based Learning in Chemical Engineering Education Using Distance Education Tools

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Abstract

This chapter will exhibit the experience of applying project-based learning in different subject matter, identifying and comprehending the efficiency of this teaching methodology from an analysis of the activities undertaken. The subjects focused on were transport phenomena and unit operations in chemical processes. The methodology of project-based learning is to associate concepts acquired during classes and integrate them with other subjects in order to integrate the parts into the whole. It develops a variety of skills in addition to technical ones, such as cooperation, communication, involvement, knowledge construction, decision making, and problem solving. All these skills being supported by the use of distance education tools. The creation of the subjects in a virtual environment sustains student materials previously required for project development. It also monitors student activity (access by frequency statistics), and facilitates communication. The motivation and interactivity aspects have been shown to be positive with students and professors systematically involved in the constructive evolution of both individual and group knowledge.

Introduction

Learning is a search for meaning, which requires understanding of the whole framework in order to relate the parts of the context. Therefore, the learning process focuses on the three primary levels leading to learning, which consist of data, information, and knowledge. The data are considered to be raw facts and when processed become information. The information is meaningful data and when refined leads to knowledge. In order to teach well, one must understand the relationship between these elements as being the path to learning in order to develop mental models that students use to understand the world and the assumptions that support these models. Learning is inherently inter-disciplinary where the students understand and construct their own meanings based on the knowledge base they have acquired.

The chemical engineering course is still a fragmented degree where the student has only one opportunity to integrate all the practical and theoretical concepts learned in five years. The course subject known as chemical projects has been the object of the association and integration of all these concepts, but such a degree requires extensive work in practical applications.

Since 2001, project-based learning has been implemented in several subjects of the undergraduate and graduate chemical engineering courses at Unicamp. The objective has been to initiate students' motivation and to continually maintain their interest in courses, so as to acquire a successful learning process. This chapter will present these experiences in different subjects, identifying the efficiency of this methodology.

Literature Review

As a literature review of learning theories illustrates, there are many labels being used to describe these methodologies. The main learning theories that influenced traditional and distance education during the 20th century were behaviorism, cognitivism, and constructivism. From these theories, some tendencies with different perspectives defended by theorists and researchers were discovered.

Behaviorism is characterized by directed instruction, where the results are reflections of the observations of human behavior, controlled by exams. Planning follows segmentation of the contents into short sequences, so that the subject matter is learned in a gradual way, step by step. It is an approach that does not promote the learning process for students, as only the professor relates the information and knowledge deciding when, how, and what to teach. The effect leads to interaction between student-student and student-professor being weak due to the learning process being understood by only one party and the other members not knowing "why" the knowledge requires relations in a general context (Forrester & Jantzie, 2003; Rodrigues, Melo, Ferreira, Pinho, & Pereira, n.d.).

The theory of cognitivism is centered on the pedagogical activity of the professor, who considers learning as a mental process involving the information with the memory path for a long time. The previous knowledge of the student and his or her constructive sense both have a determinate role in the whole learning process. This line also considers technology

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