Pilot project: to learn by teaching

Angeles Blanco and Carlos Negro
Chemical Engineering Department, Complutense University, Avda. Complutense s/n., Madrid 28040, Spain
cnegro@quim.ucm.es

***Abstract* – This paper will present the results of a pilot experience carried out in the framework of the course "Clean technologies for the pulp and paper industry", as part of the Master Science in Engineering of Industrial Processes. Professors and students have organized together the seminar "Recover paper as a raw material for the industry". The aim of this pilot project was to learn by teaching. The paper will present the methodology that was used in order to develop the seminar and the results achieved.**

Index Terms – Bologna Process, Pilot Case, Learning tools, Paper Industry, Paper Recycling.

INTRODUCTION

In view of the future, the students need to further develop a larger number of horizontal and vertical skills, in order to fulfill the industry demands from engineers. Current qualifications are characterized by providing students with specific knowledge before, while afterwards the labor market specially values people's capacity and ability to develop and apply this knowledge. A study conducts by different Departments of Chemical Engineering in Spanish universities demonstrates that the most valued horizontal skills are the following:

- Instrumental:
  - Ability to analyze and synthesize.
  - Ability to organize and plan.
  - Decision-making.
- Personal:
  - Teamwork.
  - Critical thinking.
  - Ethical commitment.
- Systematical:
  - Ability to apply knowledge into practice.
  - Autonomous learning.
  - Adaptability to new situations.
  - Motivation for quality.
  - Environmental awareness.

All these skills can be developed to a great extent through the organization of a seminar in which students take the lead in its planning, teaching and evaluation. In short, it is about learning by teaching.

Furthermore, this exercise allows developing two specific skills that are quite relevant for a Chemical Engineer: to compare and select different techniques and to plan activities.

PILOT CASE DEFINITION

Organization of a one-day seminar, prepared, taught and evaluated by the students of the course "Clean Technologies in papermaking" from the Master Science in Engineering of Industrial Processes of the Complutense University of Madrid.

Six students and two professors have been involved in this pilot case. The students are Chemical Engineers working in companies or conducting research on Paper Technology.

PILOT CASE DEVELOPMENT: BRAIN STORMING SESSIONS

The method used for the selection and organization of the seminar was to hold several teamwork brainstorming sessions where the students previously knew the content to be studied in each session and its specific aim. The sessions carried out and their objectives were the following:

Session 1. Definition of the seminar theme.

Session 2. Search and selection of information sources.

Session 3. Objectives to be achieved by the seminar.

Session 4. Definition of the program structure.

Session 5. Drafting of a survey and evaluation.

Session 6. Rehearsal of the seminar.

All working sessions had two hour duration. Below it is explained how the sessions were developed and the didactical objectives reached in each of them.

Session 1. Definition of the seminar theme

During this session the students selects the theme of the seminar, the selection is base on the following aspect:

- Spanish paper industry facts and figures
- Emergence issues for the Spanish paper industry.
- Training needs in the Spanish paper industry.

Session 2. Search and selection of information sources.

In order to prepare the seminar, the students have used different kinds of information (technical, economic, legal, regulatory, etc) from several sources; technology providers, industrial production centers, trade associations, public institutions, documentation centers, etc.

By performing this task, the student is able to synthesize and to classify information, to identify emerging technologies, to integrate different processes, to compare and to select technical alternatives, to evaluate quality criteria, etc., which all are specific skills that a Chemical Engineer needs to develop.

Session 3. Objectives to be achieved by the seminar.

In this session the objectives to be achieved through the development of the seminar were identified, reaching the conclusion that it should answer the following questions:

- What is the importance of recovering?
- What is Spain's role?
- What are the classifications of recovered paper?
- What is their price and evolution?
- Which recovered paper for which product?
- What are the pros and cons of the different collection systems?
- Which impacts have the collection systems on the quality of the recovered paper?
- What are the collecting systems in Spain?
- How much is collected through the different channels?
- Advantages and disadvantages of the container?
- Why and what for is the raw material characterized?
- What are the best practices for the inspection and reception of recovered paper?
- What is the future of recycling?
- What are the limits in paper recycling?
- Which elements have more impact on paper recycling?

Thus, the student is able to select those aspects that are more important and to ask himself/herself the appropriate questions to be answered.

Session 4. Definition of the program structure.

The aim of this session was to define the six presentations that will form the structure of the seminar to be taught. The following contents were selected for the speeches:

- Current situation of paper recovering: the contents covered by this session are the following:
    - Diagnosis of paper and cardboard recovering in Spain.
    - Statistics: Madrid region, Spain, EU, global.
    - European Declaration on recycling.
    - Importance of legislation.
- Categories of recovered paper and their economic value. The speech will cover the following points:
    - Categories of recovered paper: European norm EN643, USA classifications and other.
    - Paper products from recovered paper.
    - Prices and evolution.
- Collecting systems, focusing mainly on their types and influence on the increase of recycling rates and product quality.
- Paper and cardboard collecting systems in Spain, where the different levels are considered, according to consumption channels and the 3 m^3 container in Spain: considerations on the design of the collecting service.
- Best practices for the monitoring of recovered paper, including:
    - Inspection and control needs for recovered paper: industry requirements.
    - Recovered paper control: parameters to be controlled, guides and procedures.
    - Technological developments in equipment for inspection and control.
- Limits and impact elements in paper recycling.
    - Paper recycling limits:
        - Quality influence, availability and cost of recovered paper.
        - COST Action E48: objectives, scientific program and research lines.
    - Impact of inks on paper recycling.
    - Impact of adhesives on paper recycling.

- Actions promoting the use of recycled paper.

During the development of this session, the student has acquired content planning skills in a structured way.

Session 5. Drafting of a survey and evaluation.

One of the working sessions was devoted to the design of the evaluation survey, where different aspects related to the seminar development were included, as well as the assessment of the pilot case as teaching method, both from the students' and professors' points of view.

In the development of this session, the student gives importance to quality aspects and learns to develop processes of activities evaluation.

Session 6. Rehearsal of the seminar.

Before the implementation of the seminar to the public, the students performed a rehearsal with the professors aiming at adjusting times and contents to the previously defined objectives.

FOLLOW UP OF THE STUDENT WORKLOAD

During the sessions the student workload to realize the pilot case has been monitored, reaching the following conclusions:

- Development of the working sessions: 24 hours in total, of which half were devoted to prepare the session individually and the other half to teamwork for the working sessions development.
- Preparation of the presentations: 20 hours of individual work, authorized by the professors as many times as students have requested.
- Holding of the seminar: 6 hours

Therefore, the total workload considered necessary for the production of this case study has been of 2 ECTS, representing 27 % of the total course credits.

CONCLUSIONS

The seminar will be held on May 31 and is targeted to everyone interested in getting to know or deepening his/her knowledge on the use of recovered paper as a raw material for paper production. Moreover, it is aimed at professors and students with an interest in pilot teaching cases, serving to adapt the current higher education systems to the European Higher Education Space. The conclusions reached will be presented in the speech.

ACKNOWLEDGMENT

This activity has been carried out within the framework of the project funded by the Community of Madrid PROLIPAPEL: Clean Production of Recycled Paper: Towards Sustainability in the Production of Paper in the Community of Madrid.

REFERENCES

[1] White book of the Graduate Degree on Chemical Engineering. National Agency on the Evaluation of Quality and Accreditation. Madrid, 2006.

[2] http://www.ucm.es/info/prolipapel/