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Student-centered teaching: an experience at the Building Engineering School in Valencia, Spain

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Abstract

During the 2nd semester of the academic year 2012-13, with the aim to improve the learning process, to develop competences and skills and to maximise the opportunities for interaction between students and lecturers, and among students themselves too, several active learning strategies have been set up in the course of “Energy efficiency in building”, a specialisation course of 12 ECTS points with a interdisciplinary teaching staff. The pedagogical and didactical approach must face different external condition such as the duration of each lecture, the predictable drop of paying attention and the resulting necessity of different kind of activities. Several actions have been introduced in our lectures, as oral presentation of a self-chosen topic, intensive use of TICs, case studies, production of a poster, specific seminary on IR thermography, conference about energy classification, field trips, one minute papers. All this activities not only focus program-specific and professional competences, related to the academic discipline and a better knowledge and understanding of physical, thermodynamic laws or construction elements, but also want to train core and cross-cultural competences such as communication, management of information, teamwork, continuous learning, strategic thinking, cross-cultural behaviour, with a view to the final project presentation. The final results of the course showed the importance of the active learning actions in order to create a better learning and teaching environment and enhance the engagement of the students with the course. Despite the fixed seating and class size we could introduce many active learning activities in order to foster core competencies, learning and discussion.

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1. Introduction

Much of theoretical and field research emphasizes the importance of including emotional and motivation

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components together with learning aspects.

Emotions influence deeply and directly the cognitive process and the final performance of students. In many studies about motivation and strategies, researchers like Tapia (1997), Braten and Olaussen (1998), Pintrich (2000) point out the importance of affective and motivational components in the learning process. Tapia for example suggests that motivation affects directly the way of thinking as well as the learning process. Furthermore students must be motivated to use the strategies as well as to control and improve their cognition and effort. Motivated students can be considered self-regulated as far as they are active actors of their own learning process. Superficial, deep or strategic styles of learning are always related to the knowledge and the internalization of the final objectives.

Lecturers usually rely upon presentations to efficiently present course contents and theoretical concepts to students. In a typical lecture class, the lecturer stops talking at the very end of the period. Students gather up their notes and simply go to the next lecture. Active learning stands in contrast to "standard" modes of instruction in which teachers do most of the talking and students are passive.

Students and their learning needs should become the centre of active teaching/learning. There is a quite wide range of existing teaching strategies that can be employed to actively engage students in the learning process and increase their retention. The benefits to using such activities are many: improved critical thinking skills, increased retention and transfer of new information, heightened motivation, and enhanced interpersonal skills. Using active learning does not mean abandoning the classic lecture format, but it does take class time. Lecturers who use active learning pause frequently during the period – once every fifteen minutes on average – to give students a few minutes to work with the information they have provided. Students are asked to answer a question, to summarize important concepts in writing, or to compare notes with a partner. For some lecture-based classes, using active learning may be a bit more challenging because of room limitations such as fixed seating or class size. Breaking students into groups may not be possible, but other individual or paired activities are almost always quite possible and lead to good results too.

In Table 1 we find the four basic activities through which all students learn. All specific active learning strategies use one or more of these elements.

Table 1. Active learning basic activities

<i>TALKING and LISTENING</i>	Meaningful listening: organizing and reinforcing what students have learned relating what they hear to what they already know periodic time away from passive listening in order to absorb what they've heard explaining the main points of the lecture to a colleague
<i>WRITING</i>	Processing the new information in their own words Also suitable for individuals who prefer to learn independently
<i>READING</i>	Summary and note checks as active learning exercises in order to improve the learning process Developing ability to focus on important information
<i>REFLECTING</i>	Giving time to reflect, to connect what they've just learned with what they already know Solving some practical exercise or answering some questions on the day's topic by using the new knowledge Using the new knowledge to teach to colleagues.

The number of research studies focused on learning strategies has risen considerably since the 1980s and a lot of definitions of the concept of learning strategies can now be found. Learning strategies are the processes or actions developed by students, in a planned and reflexive way, in order to raise the expected objectives in every stage of the learning course.

Previous researches have shown that university students only use a few collections of strategies, pointing out as a reason for this situation the evaluation and teaching techniques developed by their teachers. It is important to analyse if the students adapt their learning strategies depending on the suggested teaching methodology or on the

personal experience obtained after having followed the previous courses.

A kit of core competencies that are important and necessary in most workplaces or professional activities have also been taken into account in our strategic pedagogical and didactical approach. Personal management, communication, managing information, research and analysis, project, task and organizational skills, teamwork, commitment to quality, professional behaviour, social responsibility and continuous learning have all been taken into consideration in every activity during the course. We especially have focused professional competencies, skills, knowledge and attributes valued by the professional bodies connected to different professions.

A third important theoretical background element is the Kolb's learning theory. It sets out four distinct learning styles (diverging -CE/RO-, assimilating -AC/RO-, converging -AC/AE-, accommodating -CE/AE-) which are based on a dual combination of the four-stage learning cycle (Concrete Experience (CE), Reflective Observation (RO), Abstract Conceptualization (AC) and Active Experimentation (AE)). Kolb's model is shown on Figure 1. The learning style preference itself is actually the product of two pairs of variables, or two separate 'choices' that students make, which Kolb presented as lines of axis, each with 'conflicting' modes at either end. Furthermore, there is a quite interesting and direct relationship between this model and the active learning basic activities. Reflections and observation are usually assimilated, absorbed and translated by students into abstract concepts with implications for action, which students can actively test and experiment with. It also enables in this way the creation of new experiences and so it can feedback the whole learning process.

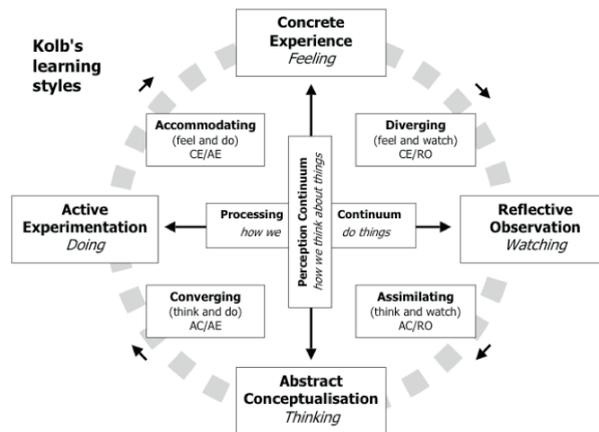


Figure 1. Kolb's learning styles.

2. STUDENTS CENTERED ACTIONS

During the second semester of the academic year 2012-13, with the aim to improve the learning process, to develop competencies and skills and to maximise the opportunities for interaction between students and lecturers, and also amongst students themselves, several active learning strategies have been set up in the course “Energy efficiency in building”.

This is a specialisation and interdisciplinary course of 12 ECTS points with 3 blocks of 3 hours weekly lectures during the last semester of the degree.

We had to develop a specific and adapted pedagogical and didactical approach in order to face different external conditions such as the long duration of each lecture, the predictable drop of attention and the resulting necessity of breaks and different kind of activities, as well as a quite large teaching team (4 lecturers) with different scientific backgrounds.

Strategic breaks during a lecture have been used to rest and to create opportunities for introducing some active learning actions. Table 2 describes the main actions that have been introduced in our lectures with some extra information about timing, developed competencies and some added examples.

Table 2. Introduced active learning activities

Type of active learning	Description	Timing	Clues
EXAMPLE			
Case studies DIMENSIONING OF A BIOMASS HEATER	A detailed description of a real or simulated scenario is given. Students solve the problem by taking design decisions	During lectures or at home (up to 30 minutes)	Practical implementation of new theoretical knowledge by solving some practical exercise or case
Note check	Comparison of notes between students focusing on summarizing key information and locating misconceptions. Filling of existing gaps in the collective understanding of the information	Up to 5 minutes.	Learning good note taking skills Monitoring whether or not students are able to identify the key ideas in the day's material.
Two minutes paper	Given an open-ended question, students spend two minutes writing their answers. The lecturer collects the answers.	Two minutes at the end of class	Identification of the most important concept or what remains unclear
Field trips CONSTRUCTION SITE VISIT IN VALENCIA	Site and research centre visit	During scheduled lectures	Approach and identification on a practical way of the main topics of the course
Questions set in group	Students work on questions set in teams, and submit one question per team.	After any oral presentation by students	Writing skills.
Working in pairs NATURAL LIGHTING IN AN ENCLOSURE	Transversal strategy that can be used for computer simulations, research work or presentation	During lectures up to 30 minutes or as home work	Collaborative work Enhancing personal communication competences
Computer simulations BUILDING'S ENERGY CLASSIFICATION	Use of programs for checking different related topics	During lectures up to 60 minutes	Training and applying of new knowledge
Small research work GREEN ROOFS	Topic is chosen by students but work is monitored	Homework	Specific knowledge enhancing
Oral presentation EN16001 Technical Guideline Energy Management systems	Presentation of the small research work or specific regulation about energy efficiency	Homework and oral presentation during lectures (10 minutes)	Communication and writing skills training

All these activities not only focus program-specific and professional competencies, related to the academic

discipline and a better knowledge and understanding of physical, thermodynamic laws or construction elements, but also seek to train core and cross-cultural competences such as communication, management of information, teamwork, continuous learning, strategic thinking, cross-cultural behaviour, with a view to the final project presentation.

At the same time these actions have given to lecturers important feedback in order to better organize the programme development and the lecturers' tuning and collaboration.

There is also a strong link to the continuous evaluation process that has been set up by following the framework of the academic regulation (mandatory continuous evaluation and final exam).

Furthermore we realised one conference about energy classification with an external lecturer and a specific seminar on IR thermography.

3. CONCLUSIONS

The final results of the course (with 98% of students passing) showed the importance of the active learning actions in order to create a better learning and teaching environment and enhance the engagement of the students with the course. The training of specific competences for the presentation of the final projects in July 2013 has also been successful.

Despite the fixed seating and class size we could introduce many active learning activities in order to create communication opportunities among students and with the lecturers and establish classroom environments that foster at the same time core competencies, learning and discussion.

The balancing between classroom activities and continuous evaluation (up to 40% of the final mark) gives both students and lecturers an important feedback about the evolution of the course. Good final marks are always strongly related to good continuous evaluation.

The intensive use of TICS (computer simulations and specific design programs) during the whole semester is another added value as well as the presence of Erasmus students from Italy and Czech Republic for the culture, strategies and approach exchange opportunities.

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