We are IntechOpen,
the world's leading publisher of
Open Access books
Built by scientists, for scientists

4,800
Open access books available

122,000
International authors and editors

135M
Downloads

Our authors are among the

154
Countries delivered to

TOP 1%
most cited scientists

12.2%
Contributors from top 500 universities

BOOK CITATION INDEX
CLARIVATE ANALYTICS
INDEXED

WEB OF SCIENCE™

Selection of our books indexed in the Book Citation Index
in Web of Science™ Core Collection (BKCI)

Interested in publishing with us?
Contact book.department@intechopen.com

Numbers displayed above are based on latest data collected.
For more information visit www.intechopen.com

EHEA: any obstacles to Converge?

Ruth Herrero-Martin, José Pérez-García, Juan P. Solano
Universidad Politécnica de Cartagena
Spain
Isabel M. Solano-Fernández
Universidad de Murcia
Spain)

1. Introduction

The Bologna Declaration acknowledges the crucial role of the higher education community for the success of the Bologna process. However, there are some obstacles to convergence in Spain, such as the need to achieve a change in teaching methodologies. This new approach will require the active participation of the academic staff.

The Engineering Accreditation Commission mentions the criteria which are intended to assure quality and to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. In the third criterion which describes what students are expected to know and be able to do by the time of graduation, the following skills, knowledge and behaviours should be underlined: an ability to function on multi-disciplinary teams; an understanding of professional and ethical responsibility; an ability to communicate effectively, the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; a recognition of the need for, and an ability to engage in life-long learning; a knowledge of contemporary issues; an ability to use the techniques, skills and modern engineering tools necessary for engineering practice.

According to Career after Higher Education, a research project involving 11 countries of the European Union, a higher quality training and better professional preparation is a real need at many Spanish Universities. Within this context this chapter focus on describing and applying the new teaching methodologies based on European Higher Education Area and its implementation on engineering subjects, such as, lecturing, laboratory instruction, cooperative learning, problem based learning, tutorial strategies, project and learning contract and the effective integration of Information and Communication Technologies.

2. European Higher Education Area

The action programme set out in the Bologna Declaration is based on a clearly defined common goal: to create a European Area for Higher Education in order to enhance the employability and mobility of citizens and to increase the international competitiveness of

European higher education; a deadline: the year 2010 and a set of specified objectives: the adoption of a common framework of readable and comparable degrees, "also through the implementation of the Diploma Supplement"; the introduction of undergraduate and postgraduate levels in all countries, with first degrees no shorter than 3 years and relevant to the labour market; ECTS-compatible credit systems also covering lifelong learning activities; a European dimension in quality assurance, with comparable criteria and methods and the elimination of remaining obstacles to the free mobility of students (as well as trainees and graduates) and teachers (as well as researchers and higher education administrators).

Within Higher European Education Area context, Institutions of Higher Learning must adapt to changes in their environment. Spanish universities are needed to make fundamental changes mainly in two ways: the adoption of comparable degrees and students´ instruction.

2.1 The adoption of comparable degrees

Bologna declaration supposes the adoption of a system essentially based on two main cycles, undergraduate and graduate. Access to the second cycle shall require successful completion of first cycle studies, lasting a minimum of three years. The degree awarded after the first cycle shall also be relevant to the European labour market as an appropriate level of qualification. The second cycle should lead to the Master and/or doctorate degree as in many European countries, not in Spain in which this master or doctorate degree formed part of the third cycle studies (5 years of degree plus 2 years of master or doctorate studies and the thesis project, 1 or 2 years more, at least, finally 9 or 10 years were needed to complete the PhD). This part has been or is being carried out and will be ready to be implemented in 2010.
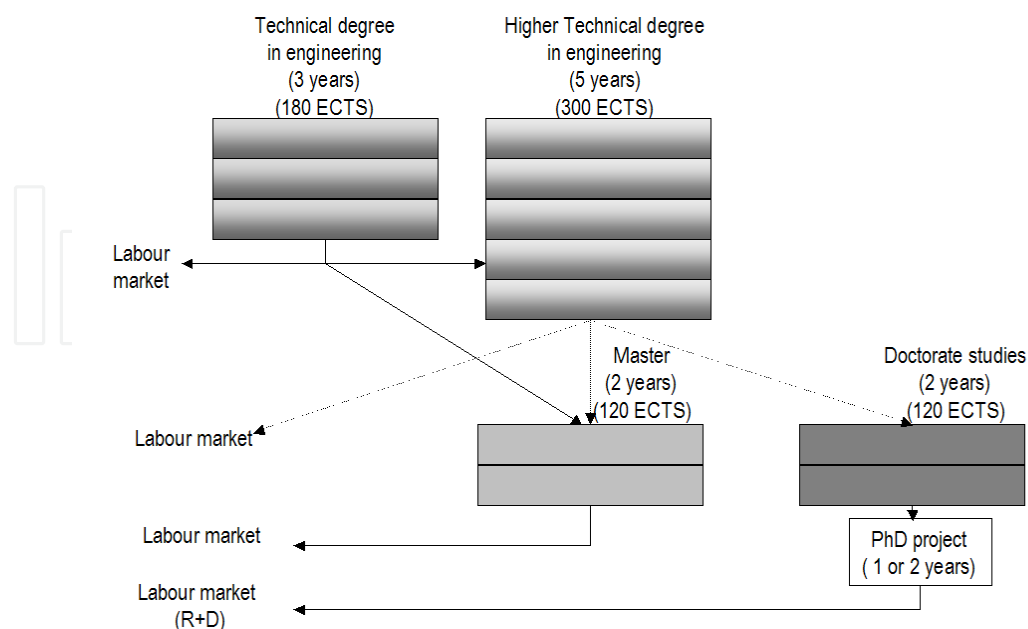
Fig. 1. Traditional Spanish Engineering Degrees

2.2 Students´ instruction

Currently, Spanish University is focused on the advancement of knowledge through research. Faculty is hired to teach, but they are fundamentally evaluated as published researchers. The highest status and most rewarded responsibility of the professor become conducting basic research and publishing results in reputable journals. Within Higher European Education Area context, Institutions of Higher Learning must adapt to changes in their environment. Universities need to make fundamental changes in the ways students are instructed; these changes are known as the new paradigm of teaching.

From the old paradigm of teaching based on transferring knowledge in the classroom to passive students to the new paradigm focused on students who are active constructors of their own knowledge. Faculty effort is aimed at developing students´ competencies (See Fig. 2). Furthermore, instructors should assume that teaching is complex and requires considerable training. As Johnson et al (2006a) mention "becoming a good instructor takes at least one lifetime of continuous effort".
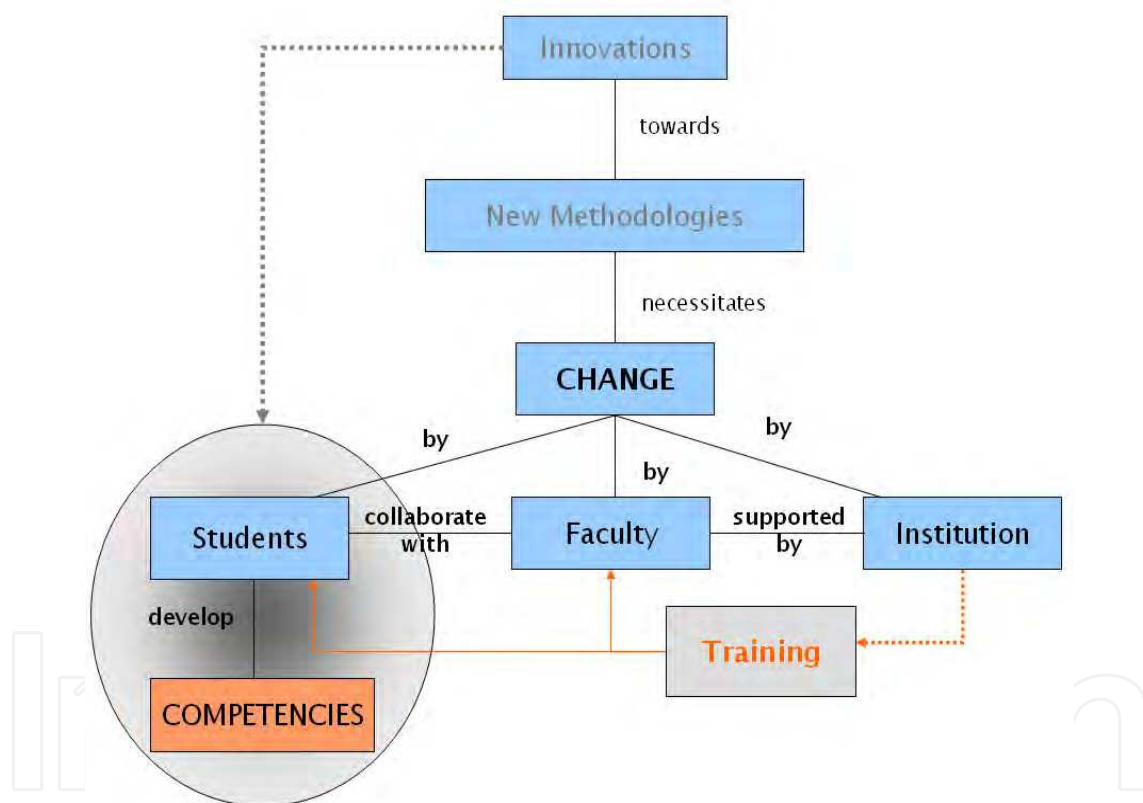

Fig. 2. Changing the old paradigm of Teaching

However, to achieve this target, instructors require training and improving skills and procedures. It should be underlined that some instructors neither want to drop this old paradigm, they continue assuming that the untrained student mind is an empty vessel into which instructors pour their wisdom, nor receive any training based on the assumption that any expert can teach.

In spite of the fact that minor modifications in current teaching practices will not solve the current problems with instruction, the new approach to instruction should be carried out

step by step, and the first step is training and making more effective the old methodologies usually employed (lecturing, problem solving classes and laboratory instruction). As Ramsden (2000a) mentioned, some teaching methods still used because teachers are unaware of alternatives.

2.3 Engineering Competences

The Engineering Accreditation Commission mentions the criteria which are intended to assure quality and to foster the systematic pursuit of improvement in the quality of engineering education that satisfies the needs of constituencies in a dynamic and competitive environment. In the third criterion, which describes what students are expected to know and be able to do by the time of graduation, the following skills, knowledge and behaviours should be underlined: an ability to function on multi-disciplinary teams; an understanding of professional and ethical responsibility; an ability to communicate effectively, the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context; a recognition of the need for, and an ability to engage in life-long learning; a knowledge of contemporary issues; an ability to use the techniques, skills and modern engineering tools necessary for engineering practise. Some Instrumental competencies, but mainly interpersonal and systemic competencies have been traditional deemphasized in engineering studies in Spain According to Career after Higher Education, a research project involving 11 countries of the European Union, a higher quality training and better professional preparation is a real need at many Spanish Universities. As Tien (2003) mentioned "Industry is no longer willing to take on the role of being an engineering finishing school".

Some Instrumental competencies, but mainly interpersonal and systemic competencies have been traditional deemphasized in engineering studies in Spain.

With respect to engineering competencies (Tunning, 2000), we asked our students about the followings competencies: Capacity for analysis and synthesis, Planning and time management, Basic general knowledge in the field of study, Grounding in basic knowledge of the profession in practice, Oral and written communication in your native language, Knowledge of a second language, Elementary computing skills, Information management skills (ability to retrieve and analyse information from different sources), Problem solving, Decision-making, Critical and self-critical abilities, Teamwork, Interpersonal skills, Appreciation of diversity and multiculturality, Ability to work in an international context, Ethical commitment, Capacity for applying knowledge in practice, Research skills, Capacity to learn, Capacity to adapt to new situations, Capacity for generating new ideas (creativity), Leadership, Understanding of cultures and customs of other countries, Ability to work autonomously, Project design and management, Initiative and entrepreneurial spirit, Concern for quality, Will to succeed. Finally, they emphasized their capacity for organization and planning, elementary computer skills, decision making, information management skills. Moreover, students pointed out other competencies, such as capacity to learn, ability to work autonomously and teamwork.

The competencies independently developed in an engineering degree have changed. Our students are "Digital Natives", that is people "accustomed to twitch-speed, multitasking, random-access, graphics-first, active, connected, the fun, fantasy, quick-payoff world of their video games, MTV, and Internet, and are bored by most of today's education, well meaning as it may be. But even worse, the many skills that new technologies have actually

enhanced (e.g., parallel processing, graphics awareness, and random access)—which have profound implications on their learning—are almost totally ignored by educators." (Pensky, 2001, 2007)

3. Teaching Methodologies

While there are no best teaching methods, some methods and combinations of methods are indisputably better than others. The next subsections focus on describing and applying the new teaching methodologies based on European Higher Education Area and its implementation on engineering subjects, such as, lecturing, laboratory instruction, cooperative learning, problem based learning and tutorial strategies. Figure 3, shows the reference framework to follow when designing teaching and learning strategies.
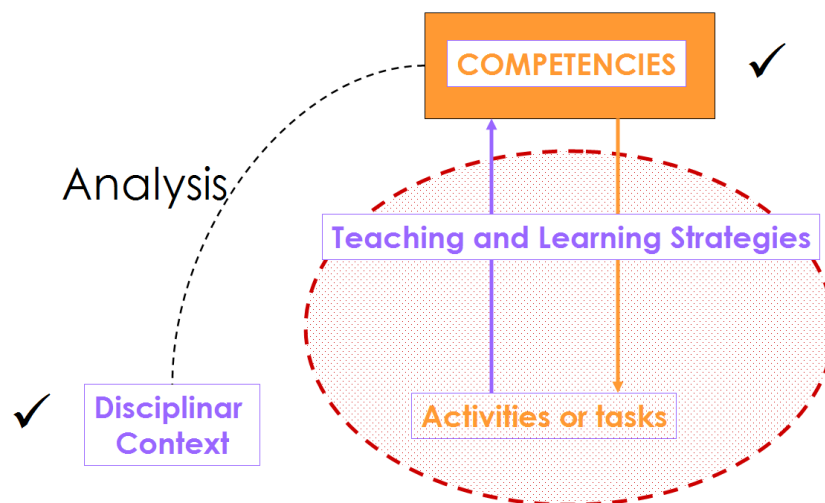

Fig. 3. The reference framework to choose the teaching and learning strategies

3.1 How to make lectures more effective?

The lecture is probably the oldest teaching method, the most criticized and still the method most widely used in universities throughout the world. There are several reasons why lecturing is so commonly used: its implementation is simple and cheap, it can be used to disseminate information in almost any field of work and a great deal of material can be presented in a short period of time.

Brown and Atkins (1990) mention the three targets to reach using lectures:

- to present elaborated material (how we do it has a capital importance, for example, the organization and presentation of lectures many times are deemphasized)
- it should provide learning, integrating information into existing conceptual networks,
- arouse students´ interest in the subject. In relation with this last target, McKeachie and Svinicki (2006a) mentioned that the role of the lecturer in Higher Education is to communicate the teacher's enthusiasm about the subject.

However, a major problem with the lecture is that students assume a passive, non-thinking, information receiving role. To achieve higher-level cognitive and attitudinal objectives alternative teaching strategies have to be interwoven. Thus, the first question to answer is: How to make lectures more effective? In 1986, McKeachie tried to answer this question: "if

we want students to become more effective in meaningful learning and thinking, they need to spend more time in active, meaningful learning and thinking- not just sitting and passively receiving" and so Jerry Evensky (1996) also mentioned "You should not think of the lecture as the passive period to be relieved by ´Now we're going to do active learning´".

One of the most valuable strategies is cooperative learning, and especially informal cooperative learning ones as Johnson et al (2006a) proposed to interweave with lecturing.

3.2 Laboratory instruction

In Engineering laboratory instruction has an important role in developing students´ competencies especially within engineering practice.

In 1999, Domin published a review of laboratory instruction styles. The most popular, most criticized and usually most commonly used style is the expository instruction. In this kind of instruction everything is prefixed, the results to be obtained and the steps to follow for achieving the objectives of the practical session.

"The chief problem with practicals is similar to the problem with lectures… It is taken for granted that students will learn if they are presented with information, so in practicals students will learn if they do things… But doing things does not imply understanding processes of enquiry or relating practice to theoretical knowledge. (...) The key to the problem is to appreciate that the traditional practical, like the lecture, is a teacher-dominated form of instruction. It leaves too little room for students to engage with the content in a way that will help them to understand it." (Ramsden, 2000b)

Beard and Hartley (1984) summarize several studies which are critical of the tendency of practical work in science to emphasise low-grade skills, to reduce student responsibility and to foster a superficial and mechanistic approach to the relations between theory and practice.

Coppola (2006) and Hofstein, & Lunetta (1982) also mentioned that this simple, cheap and comfortable method for the instructor is so poor at promote engaged and deeper learning, that nearly any strategy which promotes more active learning and decision making by students is observed to produce learning gains.

Within this context, the use of inquiry, discovery and problem-based activities are a better way than exposition to accomplish instructional goals because they are more engaging.

A very interesting non-traditional style is studio instruction. In a studio, learning and practice are intimately integrated and take place in the same space, thus transitions between theory and practice are unhindered. In the sciences, a studio implies an environment where students have access to concepts, problem solving, and experiments in the same space and practice and theory are inseparable; interactive, hands-on experiences deliver fast results. The studio teaching method is especially appealing because it does not limit itself to a single type of best practice (Coppola, 2006). Many colleges and Universities have implemented this style, such as: the University of Michigan, the University of North Carolina, California Polytechnic Institute, St. Edwards University or the State University of Georgia.

3.3 Cooperative learning

As Johnson et al (2006b) mentioned: "the new paradigm of teaching may only be operationalized and implemented through the use of cooperative learning procedures". Furthermore, from the three types of social interdependence, cooperation tends to promote

the highest achievement, most positive relationships, and greatest psychological health. They pointed out the essential components: positive interdependence, individual accountability, promote interaction, social skills and group processing. From structuring these five elements into lessons, instructors can create formal cooperative learning lessons, informal cooperative learning lessons, and cooperative base groups.

Adams and Hamm (1996) pointed out some benefits of cooperative learning that can be summarized in the following items:

- Motivate students.
- Increase academic performance and retention.
- Help with the creative generation of new ideas.
- Increase respect for diversity.
- Promote literacy and language skills.
- Help develop skills required in the community and the world of work.
- Improve teacher effectiveness.

Within this framework, Theodore Newcomb (1966) identified the peer group as the single most powerful influence in undergraduate education.

Falchicov (2001) based on similar classifications devised by Bohlmeyer & Burke (1987) and Kagan (1985) describes the following peer-tutoring techniques:

- Guided Reciprocal Peer Questioning (RPQ).
- Structured Academic Controversy (SAC).
- The Jigsaw Classroom.
- Syndicate Method.
- Team Learning.

Peer teaching is a very powerful method of learning that is greatly under-utilized, although it is highly effective for a wide range of goals, content and students of different levels and personalities and is easily adapted for large-class teaching. Researches on peer teaching such as the one by Annis (1983) demonstrated that teaching resulted in better learning than being taught. The tutor is also likely to have increased social skills and attitudes to study and self. Preparing to teach and teaching involve active thought about the material, analysis and selection of main ideas, and processing the concepts into one's own thoughts and words. (Topping, 1996)

As a conclusion, although the advantage of cooperative learning is that "can be used with some confidence at any grade level, in every subject area, and with any task" (Johnson et al, 2006). "The benefits of cooperative learning are not automatic, however, and if imperfectly implemented, the method can create considerable difficulties for instructors, most notably dysfunctional teams and student resistance or hostility to group work. Instructors who have never used the approach are advised to move into it gradually rather than attempting a full-scale implementation on their first try, and to increase the level of implementation in subsequent course offerings. To an increasing extent, they should see the learning benefits promised by the research, and as their expertise and confidence in implementing the method continue to grow, student evaluations of the team experience should improve concurrently. Most importantly, instructors who are successful in using cooperative learning in their classes will have the satisfaction of knowing that they have significantly helped prepare their students for their professional careers"(Felder & Brent, 2001).

3.4 Problem Based Learning (PBL)

McKeachie and Svincki (2006b) affirm that "Problem-based learning is (along with active learning, cooperative-collaborative learning and technology) one of the most important developments in contemporary higher education". And also mentioned that: "Cognitive theory provides good support for the idea that knowledge learned and used in a realistic, problem-solving context is more likely to be remembered and used appropriately when needed later" (2006c).

PBL approaches agree that "the starting point for learning should be a problem, query or a puzzle that the learner wishes to solve"(Felder & Brent, 2001).

As Biggs (2000a) underlined, PBL is not an ordinary curriculum with problems added, the problems are the curriculum. The traditional disciplines do not define what is to be learned, the problems do. However, the aim is not only to solve those particular problems, but in the course of doing so, the learner will acquire knowledge, content-related skills, self management skills, attitudes know-how: in a word: professional wisdom.

PBL in effect simulates everyday learning and problem solving. The problems are however, carefully selected, so that by the end of the programme, the learner is expected to cover perhaps less content than is covered in a traditional programme, but the nature of the knowledge so gained is different. Coverage, so dominant in discipline-centred teaching, is considered less important.

Cawley (1989) relates how the benefits of problem-based learning can be derived from a course introduced into an existing programme. Diagnostic and problem-solving skills essential to engineering practice are not being properly understood using traditional methodologies which are mainly focused on technical content, this method sought to develop students´ understanding at the same time as enhancing their analytical and critical skills and their ability to communicate solutions. Cawley (1989) reports that the course is not only more effective in terms of the quality of students learning, but that it costs little more to run than a conventional engineering course. It is also more enjoyable for both staff and students.

3.5 The tutorial

Currently, at Spanish University the classic tutorial situation is one-to-one tutoring, however, this is only used to explain misconceptions or to complete the contents from a previous lecture of an specific subject.

In this article three types of tutorials will be described (See Figure 4). First of all, the tutorial which correspond to an specific subject (subject's tutorial), secondly, the tutorial of the degree (degree's tutorial) and last but not least the tutorial of personal advising (adviser's tutorial).

In the EHEA the tutorial becomes a teaching strategy and will be accounted when defining the ECTS. Different authors such as Anderson (1997) and Biggs (2000b) mentioned that subject tutorials must be understood as a complement of a large lecture, not like a supplement. In this kind of tutorials, the students should do much of the work, the tutor's role is to see that they do. Instructors should set rich tasks, ask probing questions, challenge misconceptions, manage the proceedings appropriate to the students´ levels of understanding and chair the proceedings. Students see 'good' tutorials as those that promote active learning, where tutors are able to set up a good theory and atmosphere, to

facilitate good debate, to open out the quieter students, to quieten the already to open and to provide a focus for discussion and interaction that requires students to prepare in advance. Tutorials in the sciences often deal with public problem-solving, which calls for specific skills. This kind of tutorials is not implemented in most of the Spanish Higher Education system.
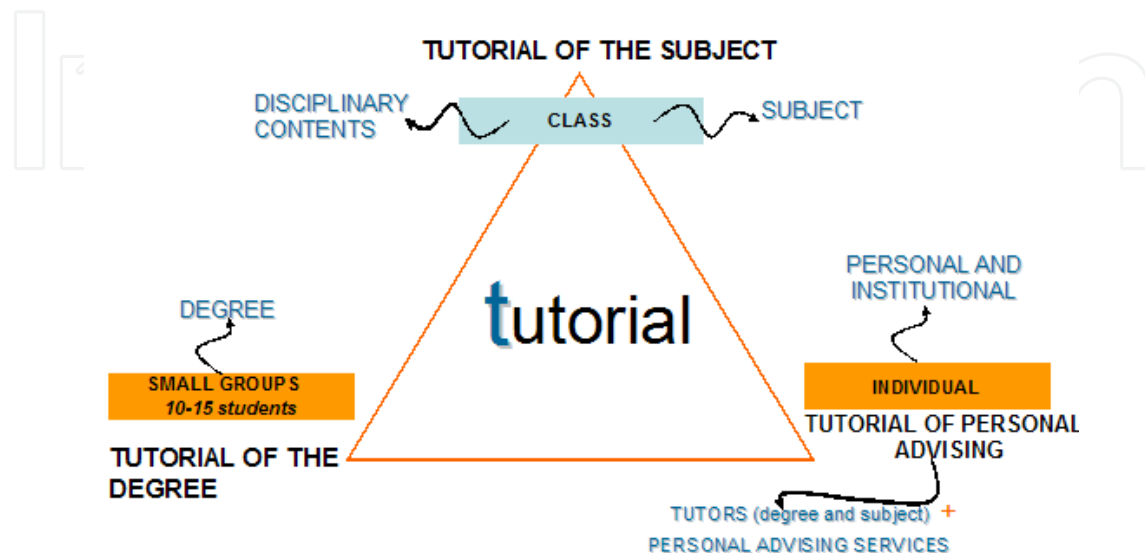

Fig. 4. Tutorial Classification

In relation with degree's tutorial, this kind of tutorial has been implemented in the last years, in our personal experience, students were active. The meeting sessions provide constant challenges and opportunities for both instructors and students to learn and also allow a personal transaction among students and between faculty and students.

Several sessions were conducted to deal about students' major concerns regarding four different aspects: the system and the university as a whole, their instructors, the subjects and their role as students. The Ramsden's questionnaire was used to help them with the different topics addressed.

In relation with the subject topics, as a general conclusion, the students mentioned that in many occasions they do not really now either the utility of the subjects they study or the real-live applications. They also mentioned that the syllabus is huge and the contents are too theoretical and not practical.

In terms of their role as students, they confess that they feel completely missed, when starting new subjects, due to the fact they do not have a clear idea about what is expected from them. Furthermore, they consider that the amount of work is enormous, they feel themselves under pressure and they criticize instructors' attitude, basically in the way instructors behave when having tutorials.

Concerning the system, they consider a priority to drop the old paradigm of teaching and want to discover, construct, transform and extend their Knowledge. They want to have an active role within their educational process and also they want to thank the possibility offered by these sessions in which they express their opinions. They textually mentioned: "The students will learn more and better if they have a prominent role building their

knowledge". They mentioned that we all should work hard to improve the Impersonal relationships among students and between faculty and students.

At present and based on the aforementioned sessions, we are trying to reinforce subject's tutorial and degree's tutorial, facilitating the interrelation between faculty and students and among students.

The adviser's tutorial is thought to deal with specific personal aspects to help the student. Thus, it is not just centered on achieving academic goals, such as improving a result in an specific subject or improving an specific skill, this tutorials try to focus on some specific personal feelings or matters such as emotional problems and try to respond to the individual student as the most important way to improve the institution labour.

4. Technology and Teaching

4.1 Why using ICTs?

There are different European projects to develop the use of new technologies such as the eLearning Initiative (2003-), which promotes the use of ICT for teaching in formal, non formal and informal contexts.

Also, i2010 A European Information Society for growth and employment which promotes the positive contribution that ICT can make to the economy, society and personal quality of life.

This is due to the fact that the use of technology as a tool can serve a number of very useful functions in college and university classrooms, E. Zhu and M. Kaplan [30] include the following:

- Providing new opportunities for enhancing student learning that otherwise would be impossible or very difficult.
- Addressing specific learning goals more effectively. Taking advantage of the rich information now available online.
- Preparing students for live in a wired world.

Chickering and Ehrman in 1996 affirmed that since the Seven Principles of Good Practice were created in 1987, new communication and information technologies have become major resources for teaching and learning in higher education. If the power of the new technologies is to be fully realized, they should be employed in ways consistent with the Seven Principles. They added that The Seven Principles cannot be implemented by technophiles alone, or even by faculty alone. Students need to become familiar with the Principles and be more assertive with respect to their own learning (Chickering & Gamson, 1987). The aforementioned principles are:

1. Good Practice Encourages Contacts Between Students and Faculty: Communication technologies can strengthen faculty interactions with all students, but especially with those students who are reluctant to ask questions or challenge the teacher directly.
2. Good Practice Develops Reciprocity and Cooperation Among Students: the extent to which computer-based tools encourage spontaneous student collaboration was one of the earliest surprises about computers.
3. Good Practice Uses Active Learning Techniques: newer technologies now can enrich and expand the opportunities focus on learning by doing. Everything is active with ICTs

4. Good Practice Gives Prompt Feedback: the ways in which new technologies can provide feedback are many.
5. Good Practice Emphasizes Time on Task: new technologies can dramatically improve time on task for students and faculty members
6. Good Practice Communicates High Expectations: new technologies can communicate high expectations explicitly and efficiently.
7. Good Practice Respects Diverse Talents and Ways of Learning: technological resources can ask for different methods of learning.

Now, considering learning as a social enterprise in which students need to interact with instructors and classmates, and education as a personal transaction among students and between the faculty and students as they work together (McKeachie & Svinicki, 2006c), the TICs and more specifically the interpersonal communicative and cooperative net tools, such as e-mails, chat, video-conferences usually called "social software" are a powerful contribution to achieve flexible communication enhancing the learning process. These easy common technology tools are implemented or are being implemented at Spanish University (See Fig. 5).
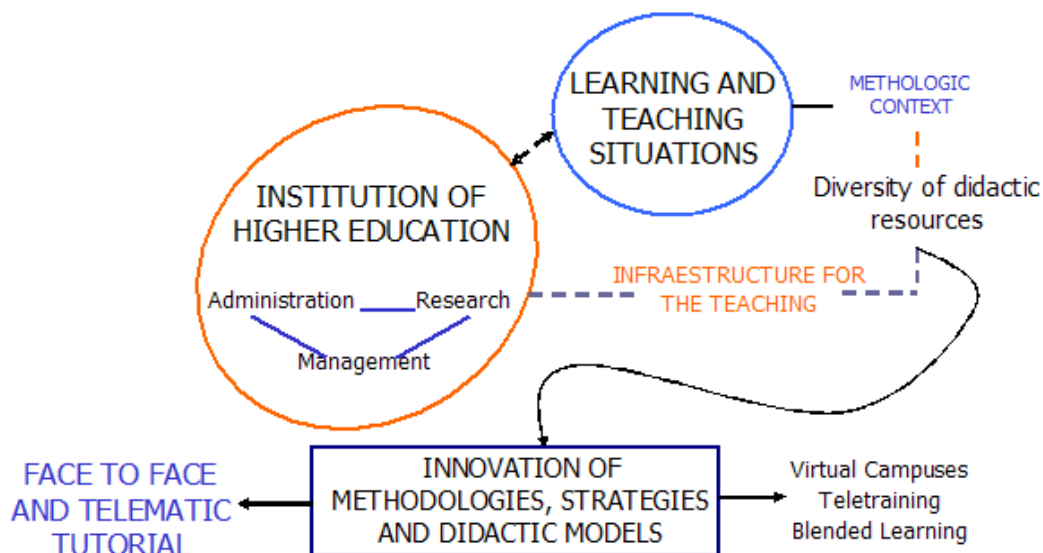

Fig. 5. Implementing ICTs at Spanish University

However, the powerful "collaborative tools" which allows to construct shared understandings and knowledge, have just broken into the Spanish academic and scientific environment. Within all applications we have selected the wikis, the weblogs (or simply blogs) and the electronic portfolio, as continuous assessment tool.

The weblogs can be used by the students as an academia web to develop the subject contents, as a communication space in which they can extend discussions beyond the classroom and even can be used to promote that students work together to construct knowledge.

Instructors also use blogs just as a diary of class activities or also to promote for example critical thinking, posting electronic PBL activities, and questionaries.

The wikis are now a mass phenomena in electronic edition, which are based on collaborative principles and shared knowledge construction, generally in an horizontal and anonymous way, although in educational circles to use them implies the user identification.

One of the most well known wikis is the "Wikipedia", there are also free tools to create our wiki such as Seedwiki (http://www.seedwiki.com/) or MediaWiki (http://www.mediawiki.org/wiki/MediaWiki).

Last but not least, one of the most used tools in innovative projects is the electronic portfolio, which can be a valuable continuous learning assessment tool. The electronic portfolio can be designed by the student using specific tools such as the free software Open Source Portfolio (http://www.osportfolio.org).

4.2 Considerations

When analyzing our students questionnaires about What kind of ICTs do your teachers use?, we realized that although it is natural to think first of the technology tool itself as a starting point (for example, teaching with technology is not just using Power point in lectures 90.2%), the use of instructional technology is more likely to be effective and appropriate (that is, facilitate student learning and own productivity) if it is integrated into a careful planning process that takes into account the various factors involved in teaching and learning.

Although, it is true that "the use of technology may change teaching methods and approaches to learning as well as attitudes, motivation and interest in teaching and learning the subject", however, "the successful integration of technologies entails the careful consideration of course content, the capabilities of various technology tools and students access to and comfort with technology, and the instructor´s view of his or her role in the teaching and learning process" (Zhu & Kaplan, 2006). Furthermore, any reflection on the implementation of ICT in Higher Education should take into account the primary competencies previously mentioned.

Within engineering context, it should be underlined that "new technology is not another way of extending educational delivery, but is itself a defining cultural and social feature of our increasingly unpredictable, changeable and contestable world. Its very application is now a necessary part of higher education´s role in preparing students for the culture of the future, as it rapidly becomes the present. In this way, innovation, itself, becomes content in the higher education curriculum, its very use a model for students to critically and creatively reconstruct for themselves in their own learning" (Light & Cox, 2006a)

5. A new assessing approach

Rowntree (1987) starts with an assertion: "If we wish to discover the truth about an educational system we must look into its assessment procedure".

Within the new teaching paradigm: "Tests and other assessments should be learning experiences as well as evaluation devices" (McKeachie & Svinicki, 2006d)

A great effort must be done in this specific field. Traditionally, assessment was simply and end-of–course exercise to determine student grades.

5.1 Learning Contracts

Stephenson and Laycock (2002a) define learning contracts as "agreements negotiated between students and staffs and, where appropriate employers, regarding the type and amount of study to be undertaken and the type and amount of assessment or credit resulting from this study".

They can cover any period of time and can be used with varying degrees of formality or academic legitimicy for a variety of institutional and/or off-campus learning and with individuals or groups of students. Typically, they involve students in negotiating their learning goals, the methods by which those goals will be meet and the means by which the achievement of the goals can be assessed and at a what level.

Developing learning contracts can encourage students to feel they have a more personal role in their education. These can also provide an important platform for personal reflection, thus learning contracts can be used as a tool which stress the importance of assessment in providing support for personal development.

As Light and Cox (2006a) mention in social subjects the expression of personal perspectives has always been valued but in the sciences this has been difficult. However, even in technical projects, asking students to write a section in reports on their personal response to the experience can be a useful way of encouraging them to understand and extend their own responses and experiences of learning.

Stephenson and Laycock (2002b) give the following conclusion: "Radical change is coming. Given the combined efforts of a number of pioneering academic staff in institutions throughout the UK, …, we are certain that the learning contract will play its part in this major paradigm shift".

5.2 The portfolio

Portfolios are now becoming a widespread way of assessing continuing developing. They are another form of assessment that focuses upon enabling students to have a wider range of choice than more traditional methods. Students may be asked to provide a portfolio of evidence of achievement in terms both of outcomes specified by the course and also a wider range of abilities and achievements which are more personal to the individual students and their particular interests (Light & Cox, 2006b).

Research on the personal development and motivation of students often stresses the importance of them having a sense of control over their own environment. This is typically expressed in terms of how many choices they are able to make in terms of what they learn and how they learn (Cox, 1996).

In engineering a portfolio can partially consist of problems or lab reports representing various course topics written up to show the student´s understanding.

However, as Biggs mentions (2000c) a portfolio is a net way of throwing the responsibility of matching the assessment tasks to the objectives on to the students. In this sense, a portfolio may be used as an example of PBL. The central problem for each student is to select an item of relevant learning, and demonstrate that it manifests the qualities nominated in the objectives. Thus, one danger with portfolios is that students may go overboard, creating excessive workload both for themselves and for the teacher, the limits must be set. (2000d)

From the classical portfolio a new and very interesting technology tool is the electronic portfolio. It presents an important advantage in comparison with the traditional portfolio, students can evaluate one another's work, perhaps a rubric for evaluation improve these

process, of course, students should be encouraged in order to get helpful and constructive comments. Gibbs (1998) emphasises the importance of peer-assesment as a teaching-learning device.

The electronic portfolio can be designed by the student using specific tools such as the free software Open Source Portfolio (http://www.osportfolio.org).

5.3 Rubrics

A rubric is a set of scoring guidelines for evaluating student work. The advantage of using good rubrics is that the students have a clear descriptor of each level of performance, this important fact enables more reliable an unbiased scoring. Rubrics can help students and teachers define "quality". Rubrics can also help students judge and revise their own work before handing in their assignments. Also, they can be used for self-assessment, a very powerful method that considerably sharpens content learning (Biggs, 2000e)

6. Conclusions

Spanish Universities are carrying out many changes to drop the old paradigm of teaching and adopt the new paradigm based on theory and research that have clear applications to instruction. Nevertheless, special attention should be pay to emphasize teaching and service, as President Donald Kennedy mentioned at Standford University: "It is time for us to reaffirm that education- that is, teaching in all its forms- is the primary task of higher education".

Within this framework, it can be mentioned that:

1. The new approach to instruction should be carried out step by step.
2. Instructors should assume that teaching is complex and requires considerable training. As Johnson et al (2006d) mention "becoming a good instructor takes at least one lifetime of continuous effort".
3. Faculty effort has to be aimed at developing student´s competencies.
4. While there are no best teaching methods, some methods and combinations of methods are indisputably better than others at realising the sort of constructive engagement with learning activities that leads to change in understanding. Such methods involve students in actively finding knowledge, meaningful learning and thinking (often in a spirit of cooperation as well as individual effort) as a route to understanding and the secure retention of factual knowledge, not just sitting and passively receiving information. These methods are in sharp contrast to those which concentrate on placing authoritative information before individual students and leaving the rest up to them (Ramsden, 2000c), (Biggs, 2000e).

Acknowledgment

7. References

Adams, D., & Hamm, M. (1996). Cooperative learning--critical thinking and collaboration across the curriculum. Springfield, IL: Charles C. Thomas.

Anderson C. (1997) Enabling and shaping understanding through tutorials, In The Experience of Learning, F. Marton, D. Hounsell and N. Entwistle (eds), Edinburgh: Scottish University Press.

Annis L.F. (1983). The process and effects of peer tutoring. Human Learning, 2, 39-47.

Beard RM, Hartley J. (1984) Teaching and learning in Higher Education. London. Harper & Row, 4th edn.

Biggs, J. (2000) Teaching for Quality Learning at University. Buckingham: SRHE and Open University Press. Reprint. [a] p.207, [b] p.86, [c], pp.219-220, [d], p.184, , [e], p.158, [f] pp.12-13.

Bohlmeyer, E.M. and Burke J.P. (1987). Selecting cooperative learning techniques: a consultative strategy guide. School Psychology Review, 16,1: 36-49.

Brown, G. and Atkins, M. (1990) Effective Teaching in Higher Education. London, Routledge.

Cawley P. (1989). The introduction of a problem-based option into a conventional engineering degree course. Studies in Higher Education, 14, 83-94.

Chickering A. W. and Gamson Z. F. (1987). Seven Principles for Good Practice In Undergraduate Education. American Association for Higher Education Bulletin, March.

Chickering A.W. and Ehrman S. C. (1996). Implementing the Seven Principles: Technology as Lever. AAHE Bulletin, October, pp. 3-6.

Coppola B.P. (2006). Laboratory Instruction, In McKeachie´s Teaching Tips, W. J. McKeachie, and M. Svinicki, 12th Edition College Teaching Series.

Cox, R. (1996). Teaching, Learning and Assessment in Higher Education. An Antropology in Action. Vol 3: 2.

Domin, D.S. (1999). A review of laboratory instruction styles. Journal of Chemical Education, 76, 543-547.

Engineering accreditation Commission. Criteria for Accrediting Engineering Programs. http://www.abet.org/Linked%20Documents-UPDATE/Criteria%20and%20PP/E001%2008-09%20EAC%20Criteria%2012-04-07.pdf

Evensky J. (1996). The Lecture. by L. Lambert, S.L. Tice and P. Featherstone (eds.), University Teaching Syracuse, NY: Syracuse University Press.

Falchikov, N. (2001) Learning Together. Peer Tutoring in higher education. Routledge Falmer p.61.

Felder, R.M. and Brent. R. (2001). Effective Strategies for Cooperative Learning. Journal of Cooperation & Collaboration in College Teaching 10, no. 2: 63–69.

Gibbs. G. (1998). Using assessment strategically to change the way students learn. In: Assessment Matters in Higher Education: Choosing and Using Diverse

Approaches. S. Brown and A. Glasner (eds.), Buckingham: Society for Research into Higher education. Open University Press.

Hofstein A., and Lunetta V.N. (1982). The role of the laboratory in science teaching: Neglected aspects of research. Review of Educational Research, 52 (2), 201-217.

Johnson D.W., Johnson R., & Smith, K.A. (2006). Active Learning: Cooperation in the Classroom. 3rd Ed.. Edina. MN: Interaction Book Company. [a] Chapter 3, [b] Chapter 1, [c] A-11, [d] 1:11, [e] 1:9-10.

Kagan, J. (1985). Dimensions of cooperative classroom structures. In: Learning to cooperate, cooperate to learn. R. Slavin, S. Sharan, S. Kagan, R. Hertz-Lazarowitz, C. Webb and R. Schmuck (eds), New York and London: Plenum Press.

Lasnier, F. (2000). Réussir la formation par competences. Montreal. Guérin.

Light G. and Cox R. (2006). Learning and Teaching in Higher Education. SAGE Publications, Reprinted. [a], pp.185-186, [b], p.180.

McKeachie, W. J. and Svinicki, M. (2006). McKeachie´s Teaching Tips. 12th Edition. Boston. College Teaching Series. [a] p 73, [b] p. 221, [c] p. 227, [d] p. 85, [e] p. 251.

McKeachie, W. J. (1986). McKeachie´s Teaching Tips. A guidebook for the beginning college teacher. 8th Edition Boston: D.C.Heath.

Newcomb T.M., and E.K. Wilson. (1966) College peer groups: Problems and prospects for research. Chicago: Aldine.

Pensky. M. (2001). Digital natives, Digital Immigrants In: On the Horizon 9. NCB University Press. Document on-line [15-10-2004] in http://www.marcprensky.com/ writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20- %20Part1.pdf

Pensky. M. (2007). How to teach with technology: keeping both teachers and students comfortable in an era of exponential change. In Becta, Emerging Technologies for learning. Volume 2.

Ramsden P. (2000). Learning to teach in higher education. Reprinted by RoutledgeFalmer.

Rowntree, D. (1987). Assessing Students: How shall we know them?. London: Harper & Row, p.1.

Stephenson, J. and Laycock, M. (2002) *Using Learning Contracts in Higher Education*. Routledge, Reprinted in 2002. [a] p.17, [b] p.174.

The European Higher Education Area. Joint declaration of the European Ministers of Education. Convened in Bologna on the 19th of June 1999. http://ec.europa.eu/ education/ policies/educ/bologna/bologna.pdf

Tien, J.M. (2003) Time to think about a Master's of Engineering. The Institute. Vol 27, No.2, 15, June.

Topping K. J. (1996). The effectiveness of peer tutoring in further and higher education: a topology and review of the literature. Higher Education 32, 321-345.

Tunning Educational Structures in Europe. http://tuning.unideusto.org/tuningeu/

UNIÓN EUROPEA. (2006) i2010: la sociedad de la información y los medios de comunicación al servicio del crecimiento y el empleo,. http://europa.eu/scadplus/ leg/es/cha/c11328.htm.

UNIÓN EUROPEA. Programme eLearning, (2006) http://eacea.cec.eu.int/static/ en/elearning/index.htm

Zhu E. and M. Kaplan. (2006) Technology and Teaching. In: McKeachie´s Teaching Tips 12th Edition College Teaching Series.

New Achievements in Technology Education and Development

Edited by Safeeullah Soomro

Since many decades Education Science and Technology has an achieved tremendous recognition and has been applied to variety of disciplines, mainly Curriculum development, methodology to develop e-learning systems and education management. Many efforts have been taken to improve knowledge of students, researchers, educationists in the field of computer science and engineering. Still many problems to increase their knowledge on daily basis so this book provides newly innovations and ideas in the field of computer science and engineering to face the new challenges of current and future centuries. Basically this book open platform for creative discussion for future and current technologies to adapt new challenges in education sector at different levels which are essential to understand for the students, researchers, academic personals and industry related people to enhance their capabilities to capture new ideas and provides valuable contribution to an international community.

How to reference

In order to correctly reference this scholarly work, feel free to copy and paste the following:

Ruth Herrero-Martin, Jose Perez-Garcia, Juan P. Solano and Isabel M. Solano-Fernandez (2010). EHEA: any Obstacles to Converge?, New Achievements in Technology Education and Development, Safeeullah Soomro (Ed.), ISBN: 978-953-307-066-7, InTech, Available from: http://www.intechopen.com/books/new-achievements-in-technology-education-and-development/ehea-any-obstacles-to-converge-

INTECH

open science | open minds