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Design of a STEM Lecturer-training Programme Based on Competencies*

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In recent years the paradigm of teaching and learning has changed, with a plethora of research being conducted in this field, but all these changes and research have scarcely affected the lecturer training programmes. This paper presents a lecturer training programme implemented in a technical university and based on the competencies that lecturers should possess. To this end, we have conducted research to determine which competencies are essential and if our lecturers consider them important or are reluctant to acquire them. The programme is also designed to bring all the acquired techniques into the classroom and apply them to the student learning process. A further factor for the success of such training programmes is that lecturers should find them useful, not only for improved student performance, but also for their future professional careers, especially in an environment where promotion is dependent on papers published and grants obtained, and where education itself becomes a secondary objective. Our training programme started two years ago and since then has achieved all these goals, thereby creating a new network of lecturers committed to engineering education research and innovation.

Keywords: teacher training; professional competencies; teaching teachers; higher education teaching

1. Introduction

The pedagogical training of university lecturers is not the result of a systematic and studied process, but rather of voluntary self-training based on seminars or training activities, personal readings, information sharing with peers, and above all on reflections arising from teaching experience. Lecturers' opinions of their own work as teachers derive from previous experience: former students who attend their lectures, the subject being taught, and mainly on their own beliefs, which induce them to work as if these beliefs were true [1]. Such beliefs are relatively static and resistant to change, as well as being consistent with the teaching style of each lecturer. It is difficult for lecturers to change their beliefs, particularly if they are intuitively reasonable [2]. It is necessary for lecturers to feel some sense of dissatisfaction for these changes to occur. They should also be provided with an intelligible and clearly useful alternative. Finally, lecturers should find a way to connect these new beliefs with those they previously held [3].

In Catalonia (a region of Spain with a population of 7.5 million people), every university is required by law to offer lecturers a learning framework. This requirement is met by specialized centres. At our university, the *Universitat Politècnica de Catalunya—BarcelonaTECH*, lecturer training programmes for new and senior lecturers are undertaken by the Institute of Education Sciences, to which the authors of this work belong. This training is voluntary because, as in other countries, no specific teacher training background is required for teaching at universities, other than knowledge of the subject to be taught. Since the training programme is voluntary, lecturer enrolment is low, especially in the current situation of economic crisis as a consequence of which very few new teachers are being hired.

Our University only offers degrees in architecture, mathematics and engineering. In our University we have no schools and departments of psychology or education, or any tradition of using social science methods. In this environment, our lecturers have the technical competencies required for teaching, but not necessarily the professional competencies required for good teaching. We prefer to use the term "competence" instead of "skill", since while the term "skill" is often used synonymously with "competence", the difference for us resides in the fact that, although skills are defined as the ability to apply knowledge and use know-how to complete tasks and solve problems, competencies are the proven ability to use knowledge and skills as well as personal, social, and/or methodological abilities, both in work or study situations and in professional and personal development [4]. Thus, competence may be conceptualized as the duality of skills (knowledge) and experience [5].

The lack of lecturer training is particularly problematic in the environment of engineering studies, which traditionally have one of the highest dropout rates in higher education. The fact that such training is voluntary poses a problem, because in our country (as in many others) the primary system for evaluating lecturers is based on papers published and research grants obtained. In such an environ-

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ment, education becomes a secondary objective. The authors of this paper agree with Patricia Cross [6] when she states that teaching will not acquire status until teachers do consider their classes as laboratories for research and innovation. The problem is that the innovation and research that are conducted at our university (mostly technical) do not use the same methods as those traditionally used in the social sciences, which are precisely the ones that would apply to education. Thus, it is necessary for our faculty also to acquire competencies related to these issues.

Our previous training programme followed the pre-Bologna pattern: it measured on-site hours and was based on course content rather than on the competencies to be acquired by the teachers participating in the training activities. It is for that reason that we wish to adapt the training activities to the Bologna model, which has led to a paradigm shift in teaching and learning. Degrees have moved from content-based learning to competencies-based learning, the focus being on learning rather than on teaching [7–9]. Furthermore, the evaluation of effort changed to the use of ECTS (European Credit Transfer System), replacing the traditional method based on the hours taught in class. This requires students to play a more active role, and stress is placed not only on technical but also professional competencies such as teamwork or effective communication.

Given these circumstances, we decided to modify our training programme with the following goals in mind:

- To provide our lecturers with attractive, high-quality training, but above all a type of training whose outcomes are transferred to the classroom and have a direct impact on students.
- To design a training itinerary for lecturers based on the competencies they must acquire as teachers, as well as providing a qualification certifying to that fact. This training should also cover lecturer evaluation and promotion.
- To increase the number of lecturers enrolling in our training programme.
- To use this training programme to promote a scholarship in engineering education research, a field of scientific inquiry that has usually been ignored by our teaching staff. Our aim is to promote the creation of an inner university network of engineering education researchers who innovate and publish their innovations.

To that end, we have been working in accordance with three different approaches: (1) A research approach to analyse which competencies all lecturers should master, and to determine whether differences exist between engineering and non-engineering teachers in the appreciation of these competencies as well as between different fields of engineering; (2) A regulations approach to determine how the training programme may be more useful for the lecturer promotion, and (3) An institutional approach to develop a scholarship in Engineering Education at our university.

2. Approach

2.1 First step: Studying lecturers' competencies

Lecturer training in Engineering has been the object of study in recent years (e.g., [10, 11]). These studies focus on the methods and tools required for quality teaching practice. The inclusion of professional competencies in engineering studies has also been widely studied. According to Smerdon [12], the ABET engineering criteria [13] can be divided into hard and professional competencies. These latter include communication, teamwork, understanding ethics and professionalism, engineering within a global and social context, lifelong learning, and a knowledge of contemporary issues. The rapid changes in contemporary society make the acquisition of professional competencies increasingly indispensable, so the question of how to teach and assess these competencies has in recent years been the focus of several works (see for instance, the comprehensive review by Shuman et al. [14]). Given the importance for our students to acquire these competencies, the following question also arises: Do university lecturers possess these competencies? More specifically, which competencies should an engineering lecturer possess?

In 2011, the Interuniversity Training Group for Teachers (GIFD), consisting of teachers responsible for training at the eight Catalan public universities, conducted a bibliographic study on the competencies that a university professor should possess. These eight universities account for 149,116 out of the 169,418 university students in Catalonia (88%). A focus group composed of 64 teachers in which all fields of knowledge were represented discussed the initial results. From this study, and once the validation was concluded, the following six competencies required by a university teacher were identified.

- Interpersonal competence: know-how to help students to develop critical thinking, motivation, confidence, and the recognition of diversity and individual needs. All this must be accomplished within a climate of empathy and ethical commitment, including ethics in professional practice as well as interaction with other individuals or groups.
- Methodological competence: knowledge of the

modern methods and strategies of teaching and learning, and awareness of different learning models. Teachers must encourage and enhance learning as well as the development of personal and professional skills through the application of appropriate methodological strategies and evaluation, in accordance with the educational context and situation.

- Communicative competence: teachers should develop communication processes in an appropriate and efficient way, which means reception, performance, production and transmission of messages through various media channels in a contextualized teaching-learning situation. These channels include face-to-face interaction as well as written documents or new media such as videos, interactive tools and social media software.
- Planning and management competence: know-how to design, guide and develop content; training and evaluation so that the results can be measured and suggestions for improvement be made; participation in interdisciplinary teams in a coordinated manner, in order to lead and/or assist in training and evaluation activities; generate new ideas and manage educational projects, with adaptation to new situations and needs depending on the available objectives and resources.
- Teamwork competence: this competence does not consist in teachers leading a group of students working together, but rather the ability of teachers to collaborate and participate as the members of a group. It concerns taking on responsibilities and commitments according to the common objectives, agreed procedures and consideration of the available resources.
- Innovation competence: know-how to create and apply new knowledge, perspectives, methodologies and resources in the different dimensions of teaching. A critical approach to one's own beliefs and methods, the search for new activities, strategies and quality criteria, all with the aim of improving the quality of the teaching-learning process.

As a consequence, our first decision was that the training programme should be based on these six competencies.

2.2 Second step: Adapting to lecturers' point of view of the six competencies

Each competence was subdivided into several indicators: e.g., "promoting confidence" for the Interpersonal competence, or "using non-verbal language" for the Communicative competence. A total of 49 such indicators were found for the six competencies. The complete list of indicators can be found in [15]. Finally, the results were endorsed by a survey among university lecturers, who were asked about the importance they gave to each competence and indicator using a forced Likert scale, the rating being as follows: "not important" (1); "somewhat important" (2); "important" (3); or "very important" (4). The survey was validated using the judges' method with a total of 54 experts, and as a result some items were modified or eliminated. The questionnaire was sent to all of the 15,209 lecturers working in the eight universities, from whom a total of 2,347 valid responses (15.43%) were received. At our university we received a total of 503 valid responses out of 2,522 lecturers (19.9%).

Our study of these data [15] shows that Teamwork and Innovation are the most poorly rated competencies. This is somewhat surprising, since these competencies are fundamental for the research activity in which our lecturers are engaged. Engineering teachers appear to separate research from teaching activities [16], so two of the most highly regarded competencies in the engineering (and research) world received a significantly lower rating from the point of view of teaching. However, analysis of which indicators belonging to both competencies are poorly rated show that they are those promoting activities outside the classroom, while indicators concerning activities in the classroom are more highly rated. In the same way, the indicators that modify the traditional lecturer-student relationship receive the lowest rating. Lecturers place more importance on scenarios in which they are the protagonists rather than those in which students have more responsibility and prominence. We believe that this is due to the fact that lecturers have failed to shift from teaching-based to learning-based education, consequently our training programme will focus on raising awareness of the importance of the indicators with the poorest rating.

A further finding was that teachers from different fields of engineering knowledge differ significantly in their appreciation of the importance of the competencies [17]. Teamwork, for instance, the most poorly rated competence, is highly rated by ICT engineers (more than 97% of whose responses were "important" or "very important"). Architecture lecturers rated almost all competencies lower than the other lecturers, except for the Communicative competence, which has the highest value over the whole population. We therefore conclude that reinforcement of the most poorly valuated indicators should be adaptive, depending on the lecturers' fields of knowledge. We have observed that, in a group of people from different fields of knowledge, people from the same field tend to gravitate together because of shared interest and the ease of working in concert. Consequently, we decided to oblige lecturers to work with people from a different area, which enabled them to discuss the reasons for this difference in their perception of the competence. They designed activities for their own specific academic environment, but also in collaboration with their colleagues in the group.

2.3 Third step: Adapting to lecturers' needs

One of the problems faced by universities is the fact that promotion is based mainly on research, so good teaching (and therefore lecturer training) seldom counts towards promotion and may even be a handicap, because every minute devoted to improving the quality of students' learning is time during which lecturers are neither producing papers nor applying for research grants. In such an environment, most lecturers who devote time to improving their students' learning experience do so because of a sense of professionalism and their own volition.

Promotion in our country is regulated by two quality agencies: one regional and one national. Both agencies define clear paths to promotion, with indications about which activities are taken into account and which are not. Enrolment in a lecturers training programme is not regarded as something valuable in terms of a possible promotion, while holding an additional degree does. Given this situation, we decided to organize the training programme as a Postgraduate degree for our lecturers.

The fact that this qualifies as a degree also helped us to organize the programme, since one of the problems was the presence of "advanced" teachers side by side with those who were "novices" in pedagogical studies (but not in years of experience as teachers). While the former had classroom experience in several innovation projects, the latter were on the threshold of their first experience in innovation and were resistant to certain ideas. This imbalance constituted one of the main problems we detected when analysing the previous training programme, which was based on a catalogue of workshops and courses in which our teachers enrolled without any restriction or organised pathway. A classification of compulsory and optional activities was established for the new Postgraduate programme, with a well-defined educational pathway and a set of prerequisites to assist in redressing the imbalance between trainees, at least in the more advanced training activities.

2.4 Fourth step: Creating a scholarship of engineering education innovation and research

In order to bring about a real change in the way our teachers address the teaching-learning process, our lecturers must consider their classes as laboratories for research and innovation. Engineering Education Research has become an emerging field of scientific research. There is a growing community of scholars involved in reflective practice concerning the scholarship of teaching and learning (SoTL). Boyer [18] defined the term "scholarship of teaching", and since then the concept has become a process in which "faculty frame and systematically investigate questions related to student learning—the conditions under which it occurs, what it looks like, how to deepen it, and so forth—and do so with an eye to not only improving their own classroom but to advancing practice beyond it" [19].

It is perhaps somewhat ambitious to ask our lecturers to undertake a deep research task in education, because they are occupied in their own field of research. However, there exist three areas of this scholarship [20]: (1) Scholarship of discovery, where contributions are primarily in the form of new knowledge; (2) Scholarship of integration, where contributions are multidisciplinary, integrative, and/or interpretive syntheses across vast prior research to identify patterns, themes, trends, needs and opportunities upon which other scholars can build; and (3) Scholarship of application, where contributions often describe how prior research into learning and teaching (either general research, or research in a specific knowledge domain such as engineering) has been applied to creating or designing educational activities.

The first scholarship (discovery) is similar to the research our lecturers are conducting in their own field of expertise; it may prove difficult to work on this scholarship in engineering education, because the research methods our engineering lecturers are using are different from those used in discovery social sciences (thus, in education). On the other hand, the second scholarship (integration), and especially the third (application), are ideal for our lecturers to work on, innovate and publish their results, since they are based on the application in their own environment of previous discovery research in education.

To this end, some positive characteristics must be incorporated [21]. The initial stimuli for becoming an Engineering Education Researcher is frequently concerned with improving students' achievement and the exploration of an unfamiliar territory [22]. According to a study by Xian and Madhavan [23], the collaboration networks in EER rely in a few key players. Were these players to leave the network, it would fall apart.

Consequently, part of the training programme is aimed at building a research network to enable lecturers interested in education to get to know each other, collaborate together and publish their findings. It is also necessary to detect the key players in our university EER network in order to provide them with institutional support to continue working in the teaching-learning process.

3. Our lecturer training programme proposal

After analysing and reflecting on what competencies were needed for our teaching staff, planning was started and a competency-based training programme for trainers was designed using an action research methodology [24] based on interviews with teachers and current and former students. A postgraduate degree in University Teaching in Science, Technology, Engineering and Mathematics (STEM) was created and officially began in September 2015.

This postgraduate programme [25] was adapted to the Bologna model, taking into account the effort made by the enrolled lecturers instead of just the hours they spend in class as students. It consists of 15 ECTS credits for student dedication, which are divided into 6 credits corresponding to the acquisition of the six basic competencies, 6 credits devoted to a final project, and the remaining 3 to complementary training. Learning consists of training activities in which postgraduate monitoring is based on a teacher portfolio.

We believe that it is necessary to introduce a project with sufficient duration for the lecturers who devise it to be able to plan, implement, observe, measure, evaluate and reflect on the innovation they wish to introduce into the classroom. To this end, the project must exceed one semester. It is important to remember that the ultimate goal of the training provided is for the concepts under study to eventually be implemented in the classroom. Therefore, although field work is proposed in various training activities, it is only in the project where all the necessary steps for teaching innovation will be taken, including time spent with the help of a mentor and peers who also participate in the training activities that are carried out in parallel with the project. The project has a minimum duration of three semesters, in the first of which the teaching practice problem to be solved must be formulated, and a study of similar experiences and possible alternatives must be undertaken. In the following term, teachers develop their own innovation in the classroom and then analyse the outcome.

Perhaps the greatest change at the heart of the training programme is the concept of training activities in which the competencies are practised. We believe that competencies must be acquired at various levels. We define three levels of skill acquisition, which correspond to the first three levels of Bloom's taxonomy: knowledge, understanding, and application [26], and we also define various elements for each competence. One of the most common problems encountered when introducing a competence is that it is usually introduced as a whole (and not as different elements) and directly at level 3—application. For example, we cannot introduce the communication competence to lecturers by analysing their lectures. The trainees must first be familiar with the basics of communication in all their aspects: verbal and non-verbal language, interpersonal communication, rules of discussion and brainstorming, creating effective multimedia documentation, and so on. This corresponds to the acquisition of the competence at level 1—knowledge. For the acquisition at level 2—understanding—they must make a critical analysis of lectures and written notes or exercises, identifying problems and proposing solutions. Then, after undergoing a process of critical self-observation and observation by others, they can analyse and improve their own communication competencies in order to achieve level 3—application.

While training activities are required to introduce fundamentals, such activities should not be overly theoretical. As in the previous example, we believe that what is needed is a basic training activity devoted to effective communication, followed by activities on voice caring and management, on building non-verbal materials and resources, and a final workshop on observation and critical monitoring of documents and activities and the lectures themselves. Within these training activities, however, much more can be learned, such as teamwork and innovation; everything depends on the activities undertaken. We therefore believe that the best way to make a programme effective is first to run the basic training activities for the acquisition of levels 1 and 2, then practise level 3 in the subsequent training activities. Only with the full range of training activities, including readings, seminars and innovation, can the acquisition of competencies be defined.

Table 1 summarizes the program. Workshops have been designed to consist of few contact hours and based on personal work and reflection. Six mandatory workshops were introduced with the aim of acquiring the six basic competencies at level 1 and 2. A seventh mandatory workshop was introduced to acquire the innovation competence at level 3; the objective of this workshop is to plan the project to be developed. The hours devoted to practising each competence are based on the nature of every training activity proposed. More than one competence can be trained at the same time: for instance, a group discussion about how and when interaction with students in a given lesson constitutes the simultaneous training in "teamwork",

Table 1. STEM programme mandatory courses at a glance

Mandatory workshops (6 ECTS)							
		Hours devoted to practising each competence					
Workshop name	**Contact hours**	**Inter-personal**	**Methodo-logical**	**Commu-nicative**	**Planning**	**Teamwork**	**Innovation**
Design of subjects based on competencies	8	4	–	6	17	4	4
Can I actively update my teaching methodology?	9	–	20	1	2	2	2
Theory and practice of teamwork	8	3	–	3	2	13	–
Innovation in education	5	–	2	–	–	–	8
Interpersonal Skills	7	15	3	2	3	–	3
Communication Skills	9	1	–	10	2	4	–
Methodologies to develop innovation in STEM	9	2	2	4	2	4	8
Complementary workshops (3 ECTS)							
Final Project (6 ECTS), at least three semesters long							

"planning" and "interpersonal" competencies, so it will consist of two hours of training for each competence even though the total time for the activity is two hours.

The complementary training activities are courses aimed at acquiring the competencies at level three, such as "Acting techniques for the teacher", "Efficient management of the teacher's workload", "Interculturality in the classroom", "Flipped classroom" or "Effective communication". All teachers may choose which complimentary workshops they will attend according to their own interests and their weaknesses and strengths (for instance, a shy person can decide to join the "Acting techniques for the teacher" workshop).

The Postgraduate diploma will be awarded if all the following conditions are met: (1) Pass all compulsory training activities; (2) Completion of training activities for a total of 9 ECTS (175 hours of performance) with portfolio-based evidence; (3) Pass at least 1 ECTS (25 hours) for each of the six core skills; and (4) Read and pass the project. Once our teachers have obtained the diploma, they are free to continue attending these workshops as part of their lifelong learning. Since some teachers feel uncomfortable with the idea of been graded, the final pass/not pass mark for every training activity is based on the portfolio evidence. Trainees are helped to pass a training activity under the personal supervision of the training staff and with no time limitations.

4. Results

The Postgraduate Degree in University Teaching in Science, Technology, Engineering and Mathematics (STEM) started in September 2015. A total of 114 participants (approximately 5% of the total number of teachers at our university) enrolled for this programme. Most participants come from the Civil Engineering department (19), Management (15) and Computer Science (15).

Most participants are in the mid-stages of their careers (aggregate and associate professors, 64%), while the least represented category in the programme corresponds to Professorships (7%). Initial stage teachers represent 29% of the participants.

Of all those enrolled in the programme, a group of 25 are already working on their final project, while 7 more will start this semester. The first graduation group of 17 teachers finish their Degrees in June 2017, with a defence of their final project before a panel of experts in education. A group of 15 more teachers are expected to complete their degrees during the next year, 2018. The names of some of the final projects are: "The use of Kahoot as a motivational tool in a Master Program"; "Just-in-time teaching improves student engagement among students at risk of failure in a CS fundamentals course"; "CampusLabs at work in innovation campuses"; "Developing the professional competence 'Autonomous Learning' in the Graphical Expression subject"; "Analysis of the impact of gamification on a Moodle-based subject"; and "Flipped Classroom as a methodology for improving students' learning". This project was awarded with the Best Project Award programme, which consists of a grant to present the work at an international Engineering Education congress.

Table 2 shows a comparison of the STEM program with the previous programmes offered at our university. The PROFI lecturer-training programme emphasised the initial training of new teachers. Despite the fact that 197 teachers were certified during the 13 years of the programme (more than 15 per year), the programme was in decline because over the years the number of enrolled teachers decreased. This was probably due to the fact that very few teachers were hired at UPC during the crisis years. The next programme

Table 2. Comparison of the STEM programme with the previous ones

Programme	PROFI	PIDU	STEM
Years	1999–2012 (13 years)	2012–2015 (3 years)	2015– . . . (2 yrs so far)
Training hours	130	150	375
Total participants	979	70	114
Certified	197	7	17 (15 more expected by 2018)

(PIDU, 2012–15) was oriented to teaching competences, with six 25-hour courses, one per competence. In terms of enrolled students, it reflected the same tendency to decline as in the PROFI programme. Analysis of the teacher's comments revealed that the two main concerns of the programme were: (1) it did not take promotion into account (so we decided to offer a Postgraduate qualification), and (2) teachers wanted a follow up of their own application of the techniques learned in class (and a final project was the best way to assure this follow up).

Since its implementation, some indicators of attendance at our teacher-training programme have improved (not only for this degree but the across the whole spectrum of training). For example, the Hours of Training/Teacher ratio per year increased by 62% over the last academic year 2015/16 when compared with 2014/15. The decreasing trend observed over the last five years has been reversed. In addition, the total number of teacher training hours per year (taking into account only the training programmes PROFI, PIDU and STEM) has increased in the last year, thus reversing the previous trend. Furthermore, the number of teachers attending courses has increased by 12% in the last year in comparison with the lowest figure recorded in 2014/15.

With regard to teachers' perceptions, the general average of surveys in mandatory subjects is 4.3 (out of 5 on the Likert Scale). A focus group was conducted in July 2017 with selected students. There was a consensus in the idea that the programme was not only useful for improving their own teaching activities, but also benefitted their academic career. The main concerns of the focus group were centered on practical issues, such as offering a broad timetable for the courses; offering courses not only on the main UPC campus (the UPC has nine different campuses), and enabling the final project to be presented as a compendium of papers instead of in the form of a Report.

5. Discussion

In our opinion, engaging our lecturers in the teaching-learning process requires similar approaches to those employed in student engagement, such as those presented by Astin [27]. According to Krause and Coates [28], in order to engage first-year students emotionally, it is necessary to: (1) Encourage them to participate in challenging activities; (2) Show them that the knowledge they are acquiring is relevant for their professional future; (3) Convince them that the profession they chose has a real impact on the world, stimulating them to reach creative solutions for resolving real problems; and (4) Create collaborative activities to enable students to cooperate both mutually and with the teachers in order to achieve a deep knowledge of their profession.

We have applied the same principles to our lecturers:

1. Encourage them to participate in challenging activities: Workshops in the training programme are more challenging because they are based on competencies (which most of our lecturers do not master); the final goal is to bring innovation into the classroom, leading to reflection on how students learn and on one's own teaching practice. Lecturers engaged in the postgraduate programme tell us that they feel confident and motivated about trying new approaches in their classes.
2. Show them that the knowledge they are acquiring is relevant for their professional future. Lecturing is often seen as a secondary objective, because it is scarcely taken into account for promotion. Creating a Postgraduate Degree that counts towards promotion is the first step towards attracting lecturers. However, it is more important to show them that their classes are an ideal laboratory for testing the integration and application of teaching and learning techniques, and that this work may lead to published papers or help them to obtain grants, thereby having a positive repercussion on their careers, above and beyond the satisfaction derived from improving students' achievements.
3. Convince them that the profession they chose has a real impact on the world, and stimulating them to find creative solutions for resolving real problems. It sometimes happens that lecturers are so focused on research that they tend to forget that one of the main activities at university is to train new graduates (in our case new

engineers) who are capable of having a real impact on the world. Moreover, lecturers must do their best for this training by offering imaginative solutions to help students not only to be better professionals but also better citizens. It is vital to stress the importance of students' needs, as well as convincing lecturers that the most important factor is not what they teach (and how they teach it), but rather what students learn (and how they learn it). As Gardner and Willey indicate, "becoming a particular type of scholar or researcher and developing a higher level of expertise in a field of academic activity involves a transformation of identity" [29].

4. Create collaborative activities to enable lecturers to cooperate in order to achieve a deep knowledge of their profession. We are creating a network of people from different schools who have never worked together before, but with common goals in teaching-learning activities. It is our aim that our former Postgraduate Degree students become mentors of the new projects by involving them in the EER network and encouraging them to try new approaches and get out of their comfort zone.

In the two years since the beginning of the new programme, a network of lecturers interested in engineering education innovation and research has emerged, giving rise to a substantial growth of teachers involved in the programme in comparison with previous programmes. These teachers are also more confident and motivated to trying new approaches, because they feel that it will also count towards future promotion.

6. Conclusions

The postgraduate programme we present here consists of an innovative design of lifelong learning for lecturers. The programme is based on the competencies a lecturer should acquire and in which the lessons learned are transferred to the classroom. At the same time, the programme is designed to help lecturers in their promotion, which makes it attractive to potential participants as well as providing them with a tool for creating a network on engineering education innovation and research.

It is our belief that the main reason for the success of the programme is that our lecturers find the training programme both challenging and useful for their future careers, apart from being of great importance for society. They also benefit from the incentive of belonging to a network of colleagues who share the same interests, concerns and goals.

Further research is required to detect the real impact this work is having on both students' learning and performance and on the number of lecturers who are becoming increasingly involved in the engineering education innovation and research field.

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