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A design pattern for skills based lecturer training programs

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***Abstract:** In recent years the paradigm of teaching and learning is changing. Among the changes we see a shift from content oriented teaching to a skills oriented teaching, student effort measuring credits and the stress on professional skills. But all these changes scarcely take place in lecturer training programs. This paper presents a research conducted in a technical university to conceive a lecturer training program based on the essential skills to have as a lecturer. Work began in 2011 and has been developed with the action-research method. First we determine the skills required to be a lecturer. This was followed by the implementation of a training program and a critical analysis of the first semesters of the program, as well as a proposal of improvement actions. Here are the steps taken and lessons learned in this process.*

Context

Adaptation of Higher Education to the European Higher Education Area (EHEA) through the Bologna Process has led to a paradigm shift in teaching and learning. Among other things, the process has meant focusing on student learning, by changing content learning for skills learning, and by measuring effort by means of ECTS (European Credit Transfer System), instead of the traditional method used before which counted the hours taught in class. The student has now a more active role. Technical and professional skills, such as teamwork or effective communication, are now stressed. But this adaptation has not affected lecturer training programs. Most training programs follow the old pattern: they are measured in onsite hours and are based on course content and not on the skills to be acquired by the teachers who attend the training activities.

Our University, the Universitat Politècnica de Catalunya, offers only degrees in architecture, mathematics and engineering. We do not have schools and departments of psychology or education, nor a tradition in social science methods among our faculty. In this environment our lecturers have the technical skills necessary for the delivery of their teaching, but not necessarily the professional skills required for good teaching. This is particularly problematic in an environment of engineering studies, which traditionally have one of the highest dropout rates in Higher Education.

In our country, each university is required by law to offer lecturers a learning framework. This function is performed by specialized centers, in our case it is the Institute for Education Sciences (hereinafter the acronym ICE in our language), to which the authors of this article belong. This centre offers training activities, with issues such as training for teaching (methods of teaching and learning, design and management of subjects, voice training, ...), research (design of experiments, statistical software, ...), teaching in English (although not an official language in our country, the university offers degrees in English due to its high internationalization) plus additional activities (first aid, cooperation to development, and so). In addition, the ICE offers a more comprehensive training targeted in particular, but not limited, to new lecturers. Note that all this training is voluntary for lecturers, since there is no specific teacher training background required for teaching at the university, other than the knowledge related to the subject to be taught.

The objective of the ICE is to offer an attractive, high-quality training to our lecturers, but above all that the outcomes of this training are transferred to the classroom and impact on students. The training activities that were traditionally offered were based on content but not on the professional skills of

lecturers. In 2011 it was decided to begin the revision of the lecturer training program, adjusting it to the Bologna model. To do so, a research plan was designed, part of which is presented in this article.

Research questions

- What professional skills are required to be a lecturer?
- What features a skills based lecturer training program should have?
- How can the lessons learned in the training program be transferred to the classroom?
- And finally, since the training program is voluntary, what measures can be set for the program to be attractive?

Theoretical framework

The pedagogical training of university lecturers has not been the result of a systematic and studied process, but a voluntary self-training based on seminars or training activities, personal readings, information sharing with peers and, above all, based on reflection on the own teaching.

The opinions of lecturers on their own work as teachers rely on the students these lecturers had, on the subject to be taught, on previous experience and on their own beliefs, that make people work as if these beliefs were true (Kagan 1992). These beliefs are relatively stable and resistant to change, consistent with the teaching style of each lecturer and it is difficult for a lecturer to change his or her beliefs, especially if these are intuitively reasonable (Prawat 1992). For this change to occur, there must be three conditions: first, the lecturer should feel somewhat dissatisfied; second, you should offer him or her some alternative intelligible and apparently useful; and third, this lecturer must find some way to connect these new beliefs with previous ones (Posner *et al.*, 1982).

Lecturers training in engineering has been studied in recent years (Dee Fink, Ambrose and Wheeler 2005, Walter, Sochacka and Kellan 2013, to name a few). These studies focus on the methods and tools for quality teaching. However, a paradigm shift in learning is taking place, and we are moving from content based to skills based learning (Mohan et al 2004, Moore and Voltmer 2003, Passow 2012). Given this situation, we think at the ICE that lecturers' training should be moved to be based on skills: for a real change in methods of teaching and learning in engineering, the lecturer training must include skills like capability to communicate, or planning and management of subjects. But training lecturers in skills ensures no change, mainly because the environment can inhibit lecturers to experiment and innovate. If the primary system to evaluate lecturers is based on papers published and research grants obtained, then education becomes a secondary objective. The authors of this paper agree with Patricia Cross (1986) when she states that teaching will not achieve a status until the teachers do not consider their classes as laboratories for research and innovation. This would require studying the foundations of learning and learning how to innovate. The problem is that innovation and research that are conducted at our university (mostly technical) do not use the same methods that are traditionally used in the social sciences, which are those that would apply to education. Thus, it is necessary that our faculty also acquire skills related to these issues.

The ICE decided in 2011 to renew the training program at our university, by adapting it to the characteristics of Bologna, in particular to all aspects related to skills based training. To do so, it was decided to approach this adaptation as a research based on the action research method (Feldman and Minstrell 2000), using the following steps: At first stage, study of the problem, the skills a lecturer should have were defined. This work was developed in 2011 in collaboration with researchers from seven other universities. The results of this work have been published in Torra *et al* 2012. Although the ICE participated in this study, this is not the work that is presented here, but the next steps of our research. The second stage involved the development of a plan of action: creating a lecturer training scheme based on skills and adapted to the characteristics of a technical university such as ours. The plan was designed; calendars, stakeholders and the indicators that would show the impact of training were established. The training scheme was launched in September 2012. After conclusion of the first three semesters of the training, data were analyzed to see its effects and a reflection was done,

identifying problems, searching their causes and preparing a plan for improvement. This stage was based on the qualitative research method Focus Group (Nielsen 2003), with the collection of evidence through interviews with trainers, surveys to trainees and a survey to all faculty of our university about training activities that the ICE should offer. With this evidence, a focus discussion was done, with trainers of the program and those responsible for it. A diagnosis and possible solutions emerged from this discussion. This stage was carried out between May and November 2014. Action research method suggests that after this stage, a research report is done, and that is what we present here: the structure of the first training program conducted, analysis of results and detected problems and what we want change for the future.

Previous work: Study of the problem

The Interuniversity Group of Teacher Training (GIFD for its acronym in our language) is a study group composed of professionals in charge of teacher training programs in the eight public universities of Catalonia, Spain. This group has carried out a study on the skills a university teacher should have. To do so, first a literature study about these skills was conducted in 2011. Then the results were endorsed by a survey among university teachers, in which they were asked about the importance they gave to each skill, and they were also asked if each particular skill was considered in their university. The questionnaire was sent to all of the 15,209 teachers working in the eight universities, with a total of 2,029 valid responses. From this study and once the validation was concluded, six skills a university teacher should have were identified:

- Interpersonal skill: know how to help students to develop critical thinking, motivation, confidence, and the recognition of the diversity and individual needs. All this must be done by creating a climate of empathy and ethical commitment, that includes ethics in the professional practice as well as interact with other individuals or groups.
- Methodological skill: knowledge of the modern methods and strategies of teaching and learning, been conscious of different learning models. Teachers must encourage and enhance learning and the developing of personal and professional skills through the application of appropriate methodological strategies and evaluation in accordance with educational context and situation.
- Communicative skill: teachers must develop communication processes in an efficient and correct way, which means reception, performance, production and transmission of messages through various media channels and in a contextualized in 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 skill: know how to design, guide and develop content, training and evaluation so that the results are measured and suggestions for improvement are made. Participate in interdisciplinary teams in a coordinated manner, to lead and / or assist in training and evaluation activities, generate new ideas and manage educational projects, adapting to new situations and needs, depending on the objectives and resources available.
- Teamwork skill: this skill is not about teachers leading a group of students working together, but teachers able to collaborate and participate as a member of a group. It is about taking on responsibilities and commitments according to the common objectives, agreed procedures and considering the resources available.
- Innovation skill: know how to create and apply new knowledge, perspectives, methodologies and resources in the different dimensions of teaching. Been critic with your own believes and methods, searching for new activities, strategies or quality criteria all aimed at improving the quality of the teaching-learning process.

First approach: the PIDU program

After the analysis and reflection about the skills for university teachers, the planning began. Each university designed their own skills based training program. We decided to run teacher training

activities that would include the theoretical basis of each skill and a practice of this particular skill. The result was the program Practice and Innovation in University Teaching (PIDU, for its acronym in our language), which consisted of six training courses, one for each skill. Each training course was equivalent to one ECTS credit, with nine hours of onsite classes plus sixteen hours of personal work, so the full program is equivalent to 6 ECTS. A series of activities and documentation were developed, and experienced teacher trainers were assigned to this purpose.

The training program began in September 2012. These courses are free of charge and are targeted only to the teachers of our university. At least three courses are offered in the spring semester and three in the autumn one. There is no compulsory order required, so a teacher can enroll each semester in the courses of his or her choice. The Institute of Education Sciences certifies participation and good use of each of these training courses, and participants who pass the six training courses also obtain certification of passing the PIDU program. No restrictions were raised about the maximum time to obtain the degree.

Impacts and barriers

The next step in the action research methodology was to analyze the action performed (the creation of PIDU program). The analysis of the problems of the first editions of PIDU was conducted between May and October 2014 through interviews with trainers and voluntary surveys to teachers who followed the training activities. The program has a total of 12 trainers and the first analysis was based on individual interviews with six of them, and in the analysis of answers to surveys conducted among participants to the training activities. The surveys were conducted after the completion of the training activities, with a total of 85 surveys answered from a total of 130 certified individuals, which are those that were invited to answer the survey. Finally, this first diagnosis was discussed in November 2014 following the Focus Group methodology at a meeting with the trainers, to which all trainers were invited, although only eight were able to attend. As a complement, in October 2014 a survey was sent to all teachers in our university ($n = 2,426$, replies received = 162) with open questions about what training activities would be of their interest, to help the Institute of Education Sciences (ICE) to make a more attractive offer.

What we observe

First, we observed a great disparity in background between participants. We expected disparity in the knowledge areas, but this aspect should not be a problem as the PIDU is oriented to educational issues and methodology. However, where there actually was a problem was in having together in the same training activity "advanced" teachers with teachers "novice" in pedagogy (not in years as a teacher). While the first have experienced in class lots of innovations, the last are considering to start his first experience of innovation, and still are reluctant to certain ideas.

It was impossible to implement what has been learned and to receive feedback. PIDU program training activities are included within an academic semester; there is usually a maximum of two months and a half between the beginning and the end of the training activity. This meant that the participating teacher began our training activity when his or her own taught subject had already started, and finished the training activity before ending to teach his or her own subject. Since most teaching actions require planning, coordination with peers, and observation, it is impossible to implement such actions in the classroom, see results and discuss the results with the trainer or with fellow participants to the training activity.

There was a very low participation. The PIDU program has six training courses offered at various editions, for a total of 21 editions offered altogether. Six of them were closed due to lack of enrollment. In the 15 training courses that were opened, there has been a total of 264 people enrolled (an average of 17.6 enrolled per training course) but only 130 of these inscriptions ended in a certification, due to the high dropout (average of 8.67 certified per training course). The 130 certificates correspond to 70 different people. These numbers are very low considering that the faculty of our university is about 2,500 teachers and that during the academic year 2013-14 there was a total of 1,597 inscriptions in the training activities offered by the ICE, these inscriptions corresponding to 939 different people. Therefore it is essential to make the program more attractive.

There was not a tracking system of the introduction in class of the improvements worked on during the program. This training program is designed so that the teachers who enroll make improvements in their teaching, i.e. bringing to class what they have learned during the program. However, in the PIDU there was not a role in charge of a follow up, supporting teachers and helping to solve doubts and able to see progress. This leads us to a related topic:

How do we establish that a teacher has "acquired a particular skill"? This problem has generated much discussion within the research group. Most universities around us issue a certificate for training activities, which is issued under attendance of a minimum number of sessions (usually 80%). But is it enough to attend? The goal is not to bring these ideas to the classroom? Should we take an examination? And, is an exam really a good tool for assessing the acquisition of a skill?

What we conclude

Training courses of more than 25 hours of work focused on a given skill is a problem because the participating lecturers are acquiring a skill in full before they have even started to improve the other skills of the program. Dividing these training activities in smaller ones should help the faculty, usually overworked, to organize their time and therefore be able to attend more training activities. Shorter training activities also allow various editions to take place throughout the year. This increase in the number of editions and the fact of having more than one training activity available for improvement of one particular skill should result in a flexible timetable that we hope will facilitate those lecturers enroll in training.

Offering a more attractive diploma could have a positive effect: changing the certificate of completion PIDU program (a diploma not recognized) into a certificate recognized by the university as a Postgraduate. This change should be attractive, especially for new lecturers who have yet to develop their career as lecturers. A Postgraduate could well complement their curriculum vitae. Furthermore, a Postgraduate qualification positions us favorably to future actions that might be established by quality agencies that would require accredited lecturer training programs.

With regard to the difference in background and level between the different participating lecturers, if we divide existing training activities in smaller ones, we can establish a classification of compulsory and optional activities, with a set of prerequisites that would specify a range that would help to normalize the level of trainees, at least in the more advanced training activities.

It is necessary to introduce a project that lasts long enough for the lecturer that makes it can plan, implement, observe, measure, evaluate and reflect on the innovation he or she wants to introduce in the classroom. For this, the project must exceed one semester. It is important to remind that the ultimate goal of training offered by the ICE is that the concepts studied end up implemented in the classroom. Therefore, although various training activities propose field work, it is only in the project where all necessary steps for teaching innovation will be taken, spending time with the help of a mentor and peers that also participate in the training activities done in parallel with the project.

Perhaps the greatest change in the essence of the training program is to move from the concept of *a training course per each skill* to the concept of *training activities in which the skill is practiced*. We believe that skills must be acquired at various levels. We defined three levels of skill acquisition, that correspond to the first three levels of Bloom's taxonomy: knowledge, understanding, and application (Bloom et al 1956) and we also defined various elements for each skill. One of the most common problems when introducing a skill is that it is usually introduced as a whole (and not as different elements) and directly at level 3, application. We cannot introduce, for example, the communication skill to a lecturer by analyzing their lectures. The trainees must first be familiar with the basics of communication at all its elements: verbal language, non-verbal, interpersonal communication, rules of discussion and brainstorming, creating effective multimedia documentation, ... This is acquire the skill at level 1: knowledge. To acquire the level 2, understanding, they must analyze critically lectures, written notes or exercises, identifying problems and proposing solutions. Then, and going through a process of critical self-observation and observation by others, they can analyze and improve their own communication skills achieving level 3, application.

Although we need training activities that introduce fundamentals, we do not need overly theoretical activities. What is needed is a basic training activity on effective communication, followed by activities on voice caring and management, on building nonverbal materials and resources, and a final workshop on observation and critical monitoring of the own lectures, documents and activities. But within these training activities much more can be learned: you can learn teamwork or innovation; everything depends on the activities undertaken. We therefore believe that the best way to make a program effective is to run first the basic training activities (and since they are elemental, they do not need to be face-to-face) and gain levels 1 and 2, then practice level 3 in the following training activities. It is only the total of training activities, readings, seminars and innovation that have been tried that will define the acquisition of skills.

Finally, our reflections led us to the conclusion that a tool is needed to manage the tasks performed, save the evidence and check whether the skill has been acquired. And that these elements complement the certificate of attendance that is issued under completion of the program.

Future developments

Rather than being redesigned, PIDU program disappears, but the experience and materials originated in PDU will be taken advantage of. A new born Postgraduate program in Lecturer Training in Science, Technology, Engineering and Mathematics is replacing the previous program and will officially begin in September 2015. The Postgraduate consists of 15 ECTS, 6 credits for acquisition of the six core teaching skills, six credits for a project and 3 to complementary training. The follow-up to the Postgraduate will be based on a Lecturer Portfolio.

The pattern of a training course per skill disappears. It is replaced by a pattern of several shorter training activities (from 4 to 10 hours of performance for the participant), which can be repeated every semester, or even with several editions during the semester if necessary, under demand. Thus, one trainee will be able to choose, and alternate the different skills improvement. It will be possible to start from basic training activities and to practice during more advanced ones, since every single training activity will be related to one or more of the six skills to be developed by the whole training program.

These training activities will be the core of the training offer of the ICE: thus, a lecturer of our university may enroll in any of these training activities without being in the Postgraduate program. To certify the training activity, it will only be necessary to perform at least 80% of the performance hours (either by attending sessions, by participating in debates or by performing any other activity). Thus, lecturers that are interested in a particular training activity will be free to do it without having to enroll in the Postgraduate program. However, trainers will propose a series of challenges to participating lecturers (search for similar experiences, discussion on how to introduce something new in a subject, ...). These challenges will be optional for normal certification of the activity, but mandatory if the person is attending the activity as part of the Postgraduate program. Lecturers passing the additional challenge will get on their Postgraduate portfolio the recognition of the hours related to each of the skills developed in the training activity, as well as all evidence provided.

Among the training activities that make up the Postgraduate, there will be a prerequisite system, so that participants attend first the basic training activities (e.g. a basic training on teaching strategies or on teaching and learning methods), and only afterwards more advanced topics (like flipped classroom). There will also be compulsory and optional training activities.

The project that is proposed must be conducted in a minimum of three semesters. During the first semester it is necessary to state the problem to be solved, to make a study of similar experiences and possible alternatives before deciding on the own strategy, and an analysis of how the impact in the classroom will be measured. Once all previous work is done, during the second semester, the improvement will be implemented in the classroom, evidence collected and all small adjustments introduced when necessary. Finally, during the third semester an analysis of the results will be done, deciding on improvements (and incorporating them in class) and preparing a final document as an article liable to be published, and participants will be encouraged to do so in relevant forums. The project will be submitted to an academic board of trainers of the Postgraduate program.

The program will include the role of a mentor. This role will be performed by a lecturer and trainer with recognized experience in innovation in teaching. The mentor will not only lead the project but will also accompany the trainee all along the Postgraduate program. The concept of the mentor is not the master or a person with authority, it is a role closer to the Japanese concept of senpai-kohai, where two people are equal, except that one has more experience and offers advice to the second.

Additionally more credits of complementary training may be gained by attending optional training activities, seminars, workshops or by reporting on materials and experiences developed. All this will be valued in performance hours and will be included in the portfolio, with the purpose of documenting the acquisition of teaching skills.

The Postgraduate diploma will be obtained if all the following conditions are met: 1) Pass all compulsory training activities; 2) Accomplish training activities for a total of 9 ECTS (175 hours of performance) and have portfolio based evidence; 3) Pass at least 1 ECTS (25 hours) of each of the six core skills; and 4) Read and pass the project.

No limitation is set neither to the time required to complete the Postgraduate nor in the number of training activities to be performed by semester, leaving maximum freedom to those who enroll in the program.

Discussion

If you want to offer a teacher training program based on skills, the skills selected for the teacher to work should be few and they have to be presented in a way that the skills can be incorporated gradually with the objective of providing continuous progress in teaching. Six, the number of skills chosen after the theoretical work, is an adequate number (but not the only one), although, if we analyze the various elements that compose these six skills, we will find aspects that overlap.

To properly develop the skills we cannot rely only on a theoretical discourse, we must develop a practical program. However, a minimum theoretical basis is essential in the case of a technical university such as ours, where teacher training has not included psychopedagogy. For example, before venturing to implement improvements it is necessary to learn how our students perceive these improvements, not only if they appreciate them, but how to know if these improvements have a positive impact on their learning.

As we want our students to acquire the skills inherent to their profession to implement them in their daily activity, teachers should develop their own skills. Skills need to be included in the courses that teachers provide and small projects to improve teaching need to be developed, all contextualized in the area of expertise of the teacher. Advanced training activities should seek the realization of these small projects and discussion with mentor, trainer and fellow participants: we must not forget that mutual support between teachers is one of the pillars of good teacher training. But working on small projects is not enough. It is important to develop a project that sets a major challenge and that raises reflection on the own teaching practice; a project that questions the own actions as we progress through the knowledge of different aspects of teaching. This final project, established like a research, is what distinguishes our approach from others that we have observed in our environment, particularly in universities without much tradition in engineering studies.

Nor can we forget that each person is different, and that teacher training is voluntary nowadays. Offering varied training activities, and the fact that one skill can be acquired in different ways and through different training activities allows teachers to set their own training plan, focusing on the points that they find more interesting to improve their teaching; all this should increase the attractiveness of the program.

Another problem of a skills based training program is to answer an uncomfortable question: "Are skills really acquired by following our program?" And linked to it, "How can we certify the acquisition of skills?" We believe that guidance of a mentor, along with the collection of evidences with a portfolio, the development of a project as described and the fact that the training activities provide the opportunity to work about the skills, all together will *create a situation from which you*

cannot leave without having acquired the skills. But more importantly, we ensure that the participating teachers have made the effort to bring some innovation to the classroom and to reflect on the process.

One of the problems observed is that if the training is voluntary, teachers who attend are usually the ones that care about good teaching. The participants to our training activities are usually teachers concerned about quality teaching, they are keen to improve and take the opportunity of these training activities to enhance their teaching resources. How to attract other teachers is a challenge we must face, but it is not an easy challenge. However, we should not be obsessed with teachers who do not attend our training activities, but we should focus on care for those who do. We must take advantage of one of the strengths we have as university teachers: we are trained for research. If we state teaching improvement as an innovation (or research) we would facilitate that teachers are placed in a well-known intellectual framework. By offering basic theories and research methods common in the environment of education and forums to publish the results, we can obtain that teachers already involved are encouraged to improve their teaching. Thus, the main challenge is, to our knowledge, to align this Postgraduate program with innovation and research, for comfort and recognition of teachers who attend.

The Postgraduate program presented here begins in September 2015, but we expect it to be only a first step. Our ultimate goal is to convert the Institute of Education Sciences at our university into a center for training and research. Therefore we advocate the creation of a research group in engineering education and technology within our university, one of its pillars being the Postgraduate programme in Teacher Training in Science, Technology, Engineering and Mathematics proposed here.

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