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Socio-Emotional Competencies in Engineering Education*

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This paper gathers the research done from 2009 to 2014 in the context of a project consisting of several educational innovation projects carried out at the Technical University of Madrid (UPM) whose aim was to improve the socio-emotional competencies of its students and professors, in line with some requirements of the European Higher Education Area such as ''preparing students for life as active citizens in a democratic society; preparing students for their future careers and enabling their personal development''. The promotion of these competencies in the engineering students can help them to optimize their academic achievement and to increase their competitiveness in the business world. Meanwhile, the socio-emotional development of the teachers can help them to create an atmosphere that supports student learning. The training techniques (online, blended and face-to-face seminars, and Coaching processes) and the outcome research methods (ad-hoc surveys and tests, pre-post evaluation using Emotional Intelligence evaluation tests) used in the five-year project are presented in this manuscript, as well as the results obtained from the 451 students and 135 professors from six engineering schools of the UPM who enrolled in the project. The benefits of these projects (a significant increase in the students' emotional quotient and in the professors' emotional skills have been achieved) and the sustainability of their activities (an emotional competencies development online classroom, accessible to the entire university community, has been launched) are highly encouraging.

Keywords: transversal competencies; emotional competencies; emotional intelligence; coaching

1. Introduction

The recent paradigm of teaching-learning proposed by the European Higher Education Area (EHEA) [1] that has placed the student at the center of education has meant a shift from a teaching-centered education to a learning-centered education. It implies that it is the student who should set objectives, manage knowledge, update it, continuously learn and be able to adapt him/herself to new and changing situations [2]. In this context, it is relevant to focus on the competencies to be acquired by the student. In the framework of the Tuning project [3], agreements related to the issue of competencies in European higher education were examined. The competencies were categorized for each degree and subject, and as transversal or generic competencies, which were subcategorized as instrumental, interpersonal and systemic. These last competencies identify the shared points that can be common to any European degree, and as many of them are related to socio-emotional abilities, they could be practiced using the Emotional Intelligence (EI) [4, 5] and Coaching [6] disciplines.

Furthermore, one of the main objectives of the EHEA is that students also reach the necessary level in personal skills in the business world. In the context of a changing and competitive society, where the demand for future graduates is in constant reformulation, it is critical to prepare students in their socio-emotional dimension. In this sense, the socio-emotional competencies are increasingly in demand and appreciated in the professional environment. Nowadays, the EI and Coaching disciplines are highly used in many companies that are investing significant resources in training their employees in socio-emotional competencies [7–9]. This is because one of the keys to the success of a company is that the employees properly regulate their emotions and mood states, as well as recognize the concerns and needs of their leaders, coworkers, customers, etc.

In the scenario described, it is easy to understand that educators in the engineering field consider the socio-emotional skills as a set of skills that needs to be included in the future engineering curriculum [10–14]. It seems clear that the development of socio-emotional competencies in engineering students affects their performance, may lead to lower dropout rates and affects the professional success of the engineering graduates [10–16]. However, although socio-emotional competencies are encouraged in very early education stages, the same has not happened in general in higher education. Its training at this educational level requires a more advanced training of teachers and the use of innovative training strategies to improve the socio-emotional competencies of engineering students [17]. Along these lines, recent researches have performed different training techniques with engineering students to improve their EI skills [14, 15, 18–22]. In this paper, the steps taken by the Technical University of

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Madrid (UPM) to encourage the socio-emotional development of its community are presented.

The UPM, in addition to seeking the success of the teaching-learning process, is giving greater importance to the acquisition of technical and personal competencies. Among the latter, socio-emotional competencies related to the development of EI are included. Some of these personal competencies have an intrapersonal character (self-awareness, self-regulation, self-motivation) and others are more social or interpersonal (empathy and social skills). The most interesting intrapersonal competencies in the university context are to recognize and regulate one's own mood states, to identify and work on personal strengths and weaknesses, to handle the impulses and internal resources maintaining motivation and focus attention on the goals rather than the obstacles. As for interpersonal competencies, the most interesting are to be aware of the feelings, needs and concerns of others and to use a healthy and enriching communication with their environment [4, 5]. A higher level of emotional competencies means increasing the efficiency and awareness of the intellectual learning process, increasing proactivity and responsibility, better regulation of stress and frustration, enriching relationships with other students and teachers, and so on. Also, the development of the socio-emotional competencies of the teacher in the classroom facilitates his/her adaptation to the new educative paradigms and seems to be decisive in preventing absenteeism and subsequent abandonment of the degree by students, in particular those in their first year [23]. In short, it is as important today to provide university students with good technical training as it is to encourage their socio-emotional development.

The current academic requirements, professional needs and the UPM's will to provide a comprehensive training to their students have inspired the project here presented. This university carried out several Educational Innovation Projects (EIP) from 2009 to 2014 designed to support its engineering students in the acquisition of socio-emotional competencies. In addition, these initiatives were focused on training engineering educators in techniques and methods of Coaching and EI designed to improve their socio-emotional performance in their teaching and tutoring activities.

The experience and the results obtained with both collectives have been really encouraging. With the result analysis of these projects we have tried to provide reliable and empirical answers to certain research questions (RQs) about the utility of EI & Coaching techniques in Engineering Education, to the training possibilities and the research instruments that can be used to evaluate and develop socio-emotional skills and to the performance outcomes that can be expected for students and professors trained in this way. Our research shows how with adequate training in EI and using Coaching techniques, the engineering students' emotional quotient can be increased, as well as the teaching staff's emotional competencies in the classroom, achieving greater student satisfaction.

The article is structured as follows: Section 2 gathers the main characteristics of the project, objectives, target participants, sample description, training and research tools, as well as the methods of recruiting participants. The different training methodologies used in the project for both students and professors are contained in section 3. Section 4 is devoted to the research methodologies. Sections 5 and 6 contain the project results and the answers to the research questions, respectively. And the conclusions can be found in section 7.

2. The main characteristics of the project

2.1 Objectives

The main objective of the project, i.e. the 5-year project versions was "*to support students and professors in the acquisition of emotional and relational skills*", much appreciated in the EHEA and in the professional world. Throughout the project, the main hypothesis has been "*Training tools from EI & Coaching can be used to increase the socio-emotional skills of university students and teachers*". Every project version was guided by concrete objectives depending on the training needs identified, the retrospective of previous editions and the research objectives. Since its beginning, target audience, training tools and research instruments were tested and extended as far as possible. A set of RQs was asked throughout the project (see Table 1).

2.2 Project life cycle

To achieve the project goal, several versions were performed with different target audiences and using a wide range of training tools and research instruments. The retrospective sessions at the end of every edition were very useful for improving and advancing the subsequent project editions. As shown in Fig. 1, several phases were performed, from the training needs identification and the target audience definition to the training plan execution and the impact evaluation, going through the training program design and the recruitment process. The training programs and the research tools used to measure its impact are presented in detail in sections 3 and 4.

2.3 The 5 project editions

Table 2 summarizes the main characteristics of every project version. The first one was dedicated

Table 1. Research Questions by areas and collectives

	Students	Professors
EI & Coaching utility?	RQ1: Are the EI and Coaching disciplines a good complement to traditional university training?	RQ5: Do the EI and Coaching disciplines provide effective methods for engineering educators?
Training possibilities?	RQ2: What training possibilities can be used to favor the students' socio-emotional skills?	RQ6: What training possibilities can be used to favor the teachers' socio-emotional skills?
Research instruments?	RQ3: What research instruments can be used to evaluate the students' development?	RQ7: What research instruments can be used to evaluate the teachers' development?
Outcomes?	RQ4: Is it possible to increase the students' emotional quotient through fundamentally experiential EI training with the help of Coaching techniques? (RQ4A). If so, is it possible to quantify this increase in terms of indicators and competencies? (RQ4B)	RQ8: According to student perception, are there differences in teacher performance in terms of socio-emotional skills between teachers trained using EI and Coaching and those not? (RQ8A). If so, what are these performance differences? (RQ8B)

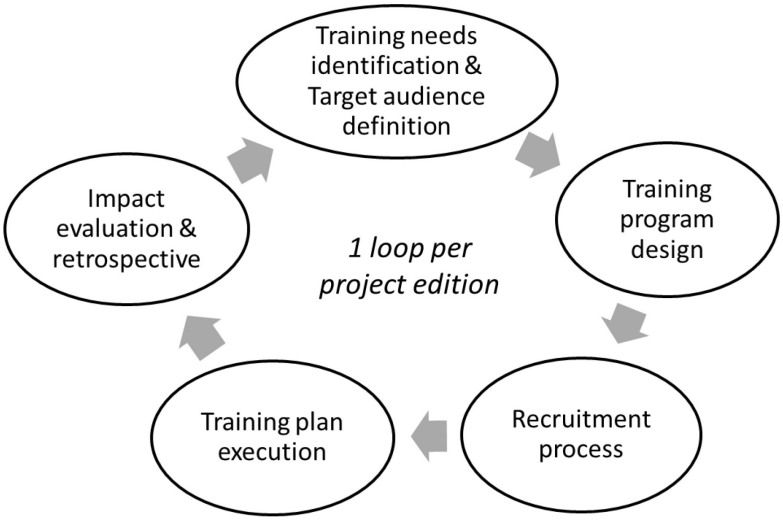

Fig. 1. Project life cycle.

to the development of emotional competencies and it was offered to professors and first-year degree students of 2 schools throughout the academic year 2009–2010. Later, during the 2010–2011 course, the objective was also to involve professors and final-year degree students of 5 schools. In both versions the students participated in practical EI seminars and followed individualized personal Coaching processes. Furthermore, the final-year students of the second edition were also offered a wide range of training activities, including workshops aimed at developing Transversal Competences (TCs) such as communication, leadership or teamwork, and individualized executive Coaching processes. During the academic year 2011–12 the target audience of the project was professors and degree students in their second, third and fourth years in order to extend the training experience to untested student collectives. The results of the students of this project were presented in [24]. Lastly, in the academic years 2012–13 and 2013–14, once the usefulness of the training for students of different academic courses and professors of different schools was tested, all students, professors and staff of the UPM were targeted and online approaches were designed to order to widen its scope.

2.4 Sample description and recruitment methodology

The UPM is one of the biggest universities in Spain, with more than 36,000 undergraduate students and 23 schools and faculties, in which a total of 39 undergraduate degrees are offered. It is a very well-known technical university in Spain and most of its schools are on international rankings. In general, its students matriculate with high marks in the entrance examination. The UPM graduates are highly regarded and demanded by engineering firms.

The target audience increased year after year in order to extend the benefits of the project and to test the usefulness of this training for students of every year and professors of different schools. Up to date, the project training has been extended as much as possible and it is available in blended-learning

Table 2. Main characteristics of the 5 project versions

	Objectives	Target audience	Training tools	Research tools
2009–2010	To study the effect on the emotional quotient of first-year students of an experiential training in Emotional Intelligence along with a Coaching process. To start an initial teacher training course in techniques of Emotional Intelligence and Coaching in order to compare their teaching performance with that of other untrained teachers at the end of the overall project.	Professors and first-year students of 2 schools involved	EI seminars Coaching processes	Ad-hoc surveys CTI test
2010–2011	To study the effect on the emotional quotient of final-year students of an experiential training course in Emotional Intelligence and transversal competencies seminars throughout the entire academic year along with a Coaching process. To provide initial training to other teachers and provide advanced training to teachers who had participated in the previous versions of the project with the same goal as the previous year.	Professors and final-year students of 5 schools involved	EI seminars Coaching processes TCs Workshops	Ad-hoc surveys CTI test Feedback 360º
2011–2012	To study the effect on the emotional quotient of second-, third- and fourth-year students of an experiential training course in Emotional Intelligence and social skills seminars throughout the entire academic year along with a Coaching process. To provide initial training to other teachers and provide advanced training to teachers who had participated in previous versions of the project with the same goal as before.	Professors and second-, third- and fourth-year students of 5 schools involved	EI and EI level 2 seminars Coaching processes TCs Workshops	Ad-hoc surveys CTI test
2012–2013	To continue with previous course studies on the influence of training in EI (including EI in professional environments) and other transversal competences, extending the project to all the students and teachers of the schools involved. New impact assessment instruments are introduced in order to expand the sources of information for the results analysis. To continue, with new issues, the teachers' training in undertaking the comparison between trained teachers and those who have received no training at all.	Professors, students and staff of all schools of the UPM, starting with professors and all students of the 6 schools involved	EI, EI level 2 and Professional EI seminars Online-learning on EI, Coaching & TCs	Ad-hoc surveys Ad-hoc motivation test Ad-hoc professors' test CTI test MSCEIT test
2013–2014	To perform the final analysis of the project results. To study the effects of online and blended training on the students enrolled. Make the comparison of results between the teachers with and without training.	Professors, students and staff of all schools of the UPM	Sustainable blended-learning on EI, Coaching & TCs	Ad-hoc surveys Ad-hoc motivation test Ad-hoc professors' test CTI test MSCEIT test MDI-EE test

Table 3. Students' Sample

	ETSITGC	ETSIT	ETSIS	ETSE	ETSIAE	ETSA	Other	TOTAL
2009–10	42	10	-	-	–	–	–	52
2010–11	45	10	30	22	43	–	–	150
2011–12	16	2	15	5	38	–	–	76
2012–13	17	11	–	10	43	4	–	85
2013–14	5	1	11	3	28	25	15	88
TOTAL	125	34	56	40	152	29	15	451

Table 4. Professors' Sample

	ETSITGC	ETSIT	ETSIS	ETSE	ETSIAE	ETSA	Other	TOTAL
2009–10	9	1	–	–	–	–	–	10
2010–11	5	4	11	–	2	–	1	23
2011–12	9	10	2	–	–	1	2	24
2012–13	10	13	3	1	18	3	–	48
2013–14	1	8	6	–	15	–	–	30
TOTAL	34	36	22	1	35	4	3	135

modality for students, professors and staff of all schools of the UPM.

The following tables present in detail the number of participants in each project version, both students (Table 3) and professors (Table 4). The participants come from different schools: Topography, Geodesy and Cartography (ETSITGC), Telecommunication Engineering (ETSIT), Computer Science (ETSIS), Technical Architecture (ETSE), Aerospace Engineering (ETSIAE) and Superior Architecture School (ETSA).

To publicize the project, several information campaigns such as publishing on the UPM website, sending informational emails or distributing posters about the project were carried out. The presentations in the schools were given on what EI is, what a process of Coaching consists of and how participating in this project could be beneficial. Since the second version of the project previous participants attended the presentations and spoke of their positive experience in order to encourage new students to join the project. In the final versions, 2012–2014, online training approaches and other activities aimed at recruiting practically all the UPM schools were undertaken. Thus, the project was extended to Civil Engineering, Physical Activity and Sport, Naval Engineering, Agriculture Engineering, Industrial Engineering and Architectural Engineering students.

3. Training methodology

The training activities that were undertaken with students and professors during the five editions of the project are now presented.

3.1 Students

3.1.1 Training in emotional intelligence

EI seminars were offered to the students in almost all project versions (from the first to the fourth). Normally, at the beginning of each semester, one or two seminars on EI were simultaneously organized which addressed experientially the competencies associated with this discipline and its application in the personal, academic and professional sphere. Each seminar lasted 32 hours spread over four consecutive or quasi-consecutive days (normally, weekends or holidays). In each seminar the students of the schools involved in the project participated jointly. Table 5 summarizes the emotional competencies and the contents addressed in the EI course [24].

Furthermore, two other courses following on from the aforementioned were designed to continue the socio-emotional training of the students enrolled in previous project versions:

- EI level 2: This seminar was designed to take a closer look at personal weaknesses & strengths and it was offered in the third and fourth project

Table 5. Emotional competencies addressed in the EI course

Intrapersonal		**Interpersonal**	
Competence	**Contents**	**Competence**	**Contents**
Self-Knowledge	• Identification and understanding of moods • Identification and understanding of social roles • Keys to improve self-esteem, confidence and internal security	*Empathy*	• The communication process • Basis for understanding others • Attitudes that promote empathy
Self-regulation of emotions	• Channelling and emotional regulation • Flexibility to deal with changes	*Social Skills*	• Situational use of communicative styles • Tools to facilitate active listening and to facilitate communication processes
Self-Motivation	• Achievement motivation • Proactivity and responsibility • Tools to set and achieve goals		

versions. The intrapersonal competencies were explored using SWOT analysis, the Core Quadrant model and positive thinking techniques; meanwhile the interpersonal competences were studied using teamwork role-plays, feedback techniques and acting.
- EI for the professional environment: This seminar was especially tailored for the professional environment and it was offered in the fourth version of the project. In this case, the intrapersonal competences were examined using self-marketing role-plays and Coaching approaches, while the interpersonal competences were examined using the Canvas model, problem solving strategies and project presentations.

3.1.2 Coaching processes

In the first three versions of the project Coaching processes were offered to the students. These processes usually started a few weeks after the completion of the EI seminars. They were spread throughout the whole semester, normally, 6 or 8 sessions distributed over 2 or 3 months. The students chose freely and confidentially an objective and they were supported by coaches. The benefits of these personalized improvement processes were especially satisfactory when these were performed after the EI seminars because the students could deal individually with issues raised in the seminars. The goals set were related to personal, academic or professional areas, however because of the nature of the Coaching, sometimes several areas was dealt jointly.

3.1.3 Training in specific transversal competences

In some versions of the project (second and third), once the seminars in EI were finalized and while the Coaching processes were underway, the students were able to attend workshops offered about several specific transversal competences to deal with in more depth the socio-emotional competencies of a professional-academic character introduced previously in the EI seminar. The competencies addressed (teamwork, time management, communication, leadership and conflict resolution) are critical in the professional environment and very important in a university educative model.

3.1.4 Training supported by online platforms

In the final versions of the project (fourth and fifth) online approaches to facilitate the scope of the training project were used. In recent years the UPM has provided its students and professors with an online platform named "*Puesta a Punto*" (PaP) in order to deal with transversal competences development and other issues. After the favorable experience of previous versions, a new module related to emotional, social and systemic competencies was incorporated into the PaP platform. There are two versions of the module, one for students and the other for professors & other staff. The students' module contains four courses related to intrapersonal & interpersonal intelligence, Coaching techniques and professional competences. Several online methods have been used to make up these courses: written manuals, interactive exercises, recorded classes, practical videos, and so on. Moreover, 16 hours of seminars certified by the UPM are offered to consolidate the knowledge acquired on the online courses. Finally, it is remarkable that since its beginning, the two modules have been visited by more than 5,000 students and 2,000 teachers and other staff.

3.2 Professors

3.2.1 General training program on EI & Coaching

Several seminars were conducted in order to address the topics depicted in Table 6.

3.2.2 Training supported by online platforms

As mentioned above, a new module related to emotional, social and systemic competencies was incorporated into the PaP online platform. This module contains three courses related to intrapersonal & interpersonal intelligence, EI & Coaching techniques for professors and professional competencies for team management. Several online means were used to build this module.

4. Research methodology

Several research instruments were used and descriptive-exploratory or quasi-experimental analyses were performed in order to obtain reliable research results that reflect the impact of the training actions

Table 6. Topics addressed in EI & Coaching courses for UPM teaching

Emotional Intelligence Topics	Coaching Topics
Introduction to EI for teaching	Introduction to Coaching for teaching
The personality and needs of the students	The Roger's approach as accompanying strategy
EI tools for their use in teaching	Coaching tools for their use in teaching
Communication processes	Leadership and motivation for professors
Feedback techniques	Generation of habits and creativity
Nonverbal communication in the classroom	Management of the student's talent

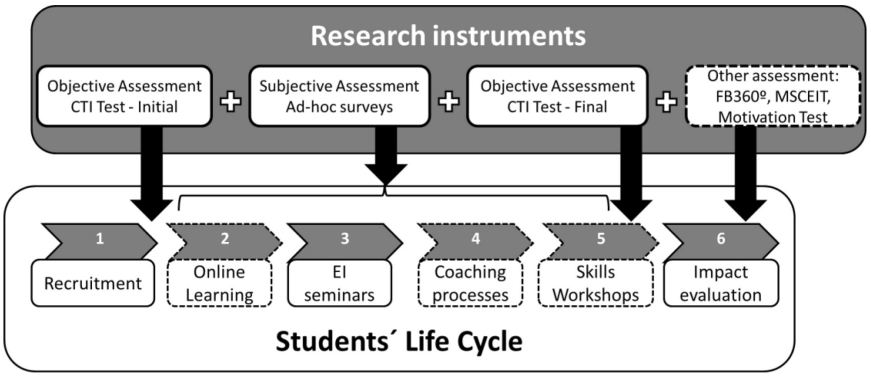

Fig. 2. Research instruments used across the students' life cycle.

undertaken in the project. The instruments and approaches applied with students and professors are described below:

4.1 Students

To understand the usage of the research instruments, it is important to keep in mind the students' life cycle in the project versions as depicted in Fig. 2. It shows how the research instruments were introduced during this cycle: before, throughout or after the training activities. As can be observed, some graphic elements have discontinued lines representing their optional or temporal character in the general schema of the project (for example, online learning was only available in the last ones).

By using the following research methods and their respective measurement tools, the emotional evolution and the development of various socio-emotional skills of participating students were measured. As described in the next section, the research data have been processed, reported and triangulated to obtain the results and relevant conclusions of the project.

4.1.1 Research method 1: Evaluation using ad-hoc surveys

A set of ad-hoc surveys were designed in order to evaluate in a systematic way the subjective perception of self-development experienced by the participants and their satisfaction with the training activities performed. To avoid the elation after the seminars, processes or workshops from contaminating the ratings given, the surveys were sent to the participants two weeks after finishing each activity.

4.1.2 Research method 2: Pre-post evaluation using ''Constructive Thinking Inventory''

A pre-post strategy based on two measurements was performed in order to evaluate in an objective and rigorous way the emotional development of the participating students. Firstly, a pre-evaluation was carried out before the start of the first training activity, and secondly, a post-evaluation at least three months after the end of the training process. The psychological tool used for this purpose was the CTI test or Constructive Thinking Inventory [25], which is one of the most widely used and proven tests to measure the ''emotional quotient'' of a person, since it allows the evaluation and prediction of many of the social or emotional skills attributed to the EI field [4, 5]. The validity and reliability of this instrument with Spanish population has been tested enough, allowing many of the social or emotional skills attributed to the EI field to be evaluated and predicted [4, 5].

4.1.3 Research method 3: Other studies with additional instruments used for the students' evaluation

In the second version (2010–11), Feedback 360º tools were also used to obtain an assessment of the student evolution from the point of view of classmates, family, friends and teachers. In the last two versions (2012–13 and 2013–14), the Mayor Salovey Caruso Emotional Intelligence Test (MSCEIT) and the Motivation Diagnosis Instrument for Engineering Education (MDI-EE) were incorporated. The MSCEIT test [26] was created by the ''fathers'' of EI and it is extensively used in the USA to evaluate emotional development. But in our experience, the length of time needed for the test (around 1 hour) made the organization of the 16 hours of seminars where they were used difficult and the flexible configuration of the workshops performed in the later versions of the project made it difficult to perform the pre-post approaches. The MDI-EE [26] can be completed quickly (around 5 minutes). It has enabled studying the motivational differences between students trained and not-trained in EI.

4.2 Professors

The instruments and approaches applied with the professors are described below.

4.2.1 Research method 1: Evaluation using ad-hoc surveys

In order to evaluate in a systematic way, the subjective perception of knowledge acquisition of the participants in the EI & Coaching courses, as well as to know their satisfaction and the perceived utility of this kind of training, a set of surveys were designed.

4.2.2 Research method 2: Multi-subjective evaluation by their own students

In order to analyze the impact of the professor training on their teaching activities, a multi-subjective evaluation approach was adopted and a new instrument, Teacher Emotional Skill Survey (TESS), was designed. Students were asked about the emotional performance of the professor evaluated. A group of teachers who had attended one or more seminars in the project and a control group of teachers without previous training neither in EI nor Coaching were evaluated on their emotional skills in class. This test covers the areas dealt with by the training programs provided to the professors and its elaboration process is based on the socio-emotional dimensions and behaviors found to be most relevant in the professor's performance throughout the project.

5. Results and discussion

5.1 Results obtained with the students

The results obtained with the instruments and approaches applied to the students are described and discussed below.

5.1.1 Research method 1: Evaluation using ad-hoc surveys

This section collects the main results obtained in the surveys after each of the formative phases described in Section 3. In all cases, the response range was a scale from 1 (strongly disagree) to 4 (strongly agree).

5.1.1.1 Training in emotional intelligence (1st, 2nd, 3rd and 4th version)

Figure 3 shows the results of the different versions of the project and the total mean of the ratings given by the 118 participants who completed the survey (of a total of 197 students who attended) after each edition of the seminar throughout the different versions of the project. Although the averages are in all cases high, it is interesting to note that those given by the students in the first and second years on all the items are the lowest (version 09–10), while the marks given by more senior students are among the highest. This may be due to senior students starting with greater emotional maturity which allowed them to get more out of the seminars (see section 5.1.2.2). Another reason may be the greater usefulness that senior students see in this type of training to help them face entering the labor market. However, the pattern of marks on the graph is the same for all groups of students.

It is remarkable the high value given by the students to the methodology used (primarily experiential) and the fulfillment of expectations that the students had of the course. Among the highly-rated items related to self-perceived emotional training are: the increase in emotional self-awareness, a positive mood to face different tasks, listening skills, flexibility to deal with changes and the channeling of emotions.

In all surveys, the participants could also write some qualitative comments about their experience. After the EI seminar, the following comments show the importance that students gave to this type of training: "I think this course should be a tool to give to students at university as they have to face some challenges that require a lot of effort and sacrifice. It would provide them with a guide to remind them of what they want to achieve and why they are making such an effort. I think the academic improvement of students would be tremendous"; "A very positive experience. I am glad that my university emphasizes both technical and emotional training"; "I have learned to distribute my work better. I feel good, I have learnt to keep my word and I've grown a lot personally"; "It was a fun and rewarding experience that teaches you to know yourself, be better".

Figure 4 shows the average results of the survey of the two EI level 2 seminars conducted in the project. A total of 18 students completed the surveys (of 36 students attending). The scores are even higher than those of the EI level 1 course. The students greatly

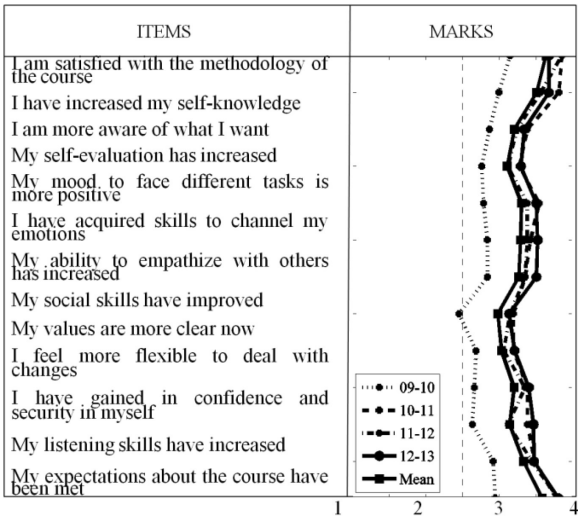

Fig. 3. Survey results per course of the EI seminars performed from 2009 to 2013 and survey results mean.

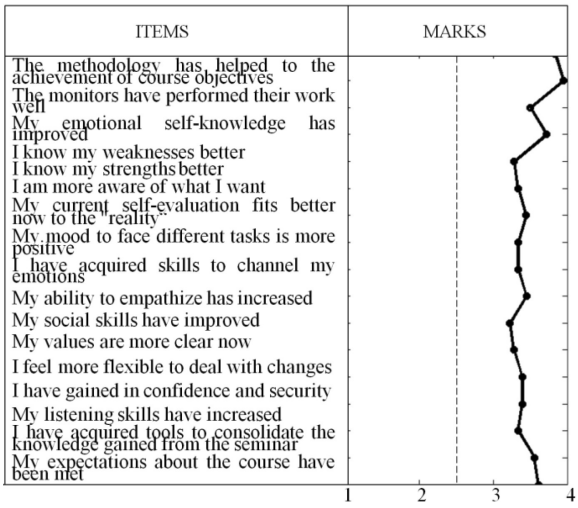

Fig. 4. Survey results of the EI seminars level 2 performed from 2011 to 2013.

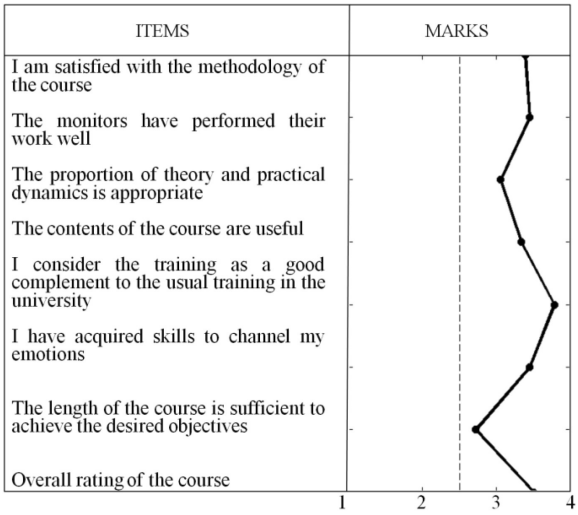

Fig. 5. Survey results of the EI seminars on Professional Environments performed from 2012 to 2013.

valued the methodology used in the course and claim to know more about their strengths and weaknesses and have acquired tools to consolidate the knowledge gained from the seminar. What is noteworthy are the high scores on increased empathy, flexibility, security and self-confidence and a current self-valuation better fitted to reality after the seminar.

Figure 5 shows the results of the two EI seminars in professional environments. A total of 18 students completed the surveys (of 41 students attending). It is a shorter course than EI1 and EI2 and students reported this as something unfavorable. It is worth noting that students consider this type of training as a good complement to the usual training at the university, with a score very close to 4. In line with the results of the other courses, the students considered that their skills to channel their emotions increased.

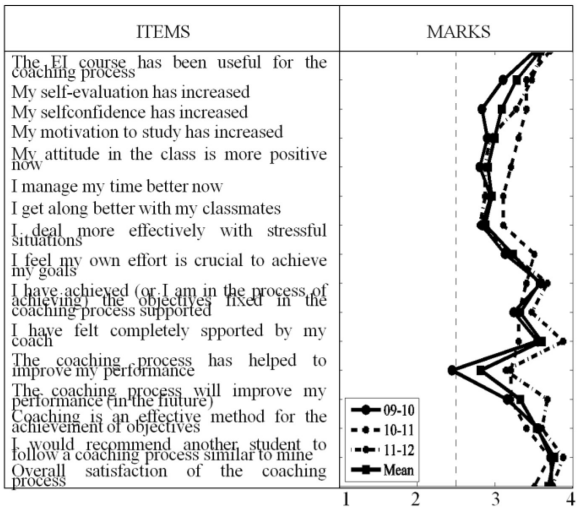

Fig. 6. Survey results per course of the Coaching process performed from 2009 to 2012.

5.1.1.2 Coaching processes (1st, 2nd and 3rd version)

Figure 6 shows the results of the different versions of the project and the total mean of the ratings given by the 49 students who answered the survey at the end of their Coaching processes (of a total of 142 students attending). Again, the scores given by the students of the first two years are generally lower than those given by higher year students. However, in all cases students believed that Coaching is an effective method for achieving objectives.

Quantitatively, the high value given to the awareness that their own effort is crucial in achieving their goals and how the Coaching process will improve their academic performance is remarkable. This item has a higher value in relation to the future than to the present, which may be due to the fact that they think they need a period of time to implement the tools acquired in the Coaching processes. It may also be because many of the goals they worked on in their Coaching processes had a more personal rather than academic or professional character. Another possible explanation is that in many Coaching processes, even if the goals were academic, they covered the first part of a longer process. For example, the goal "to pass all the exams this semester" was part of a longer term goal, namely, "to end the degree in the next two years".

The high values given to their self-valuation, self-confidence and increase in motivation are also striking. These are especially important in engineering degrees where students, who typically come from secondary school with very good marks,

have to deal with subjects with a high level of difficulty and with high failure rates, which makes students lose confidence in themselves.

In addition, in the survey the students were asked about what skills they thought had improved the most. Some of those mentioned were the following: self-knowledge, motivation, self-esteem, assertiveness, discipline, self-confidence, goal achievement, time management, communication and responsibility. Other common aspects that students feel they improved through the Coaching process are their attitude in class, time management, the relationship with their classmates and their ability to handle stressful situations.

5.1.1.3 Training in specific transversal competences (2nd and 3rd edition)

Figure 7 shows the ratings given by the students who participated in the specific workshops of Communication (C), 31 students answered out of a total of 54, Time Management (TM), 34 students out of 50, Leadership (L), 32 out 50, Conflict Resolution (CR), 6 out 20 and Teamwork (TW), 32 out of a total of 32, from 2010 to 2012.

As can be seen in the figure, the seminar with the best scores in most of the items is Communication, although all the questions have scores above 3 in the other seminars, with the exception of the question about the length of the courses. It is remarkable that the question asking if the training received is a good complement to the usual training at university is one of the questions with the highest scores in all the seminars. In the final two years of a degree it is much more common to apply methodologies which involve competencies such as communication, team work, or leadership, so the students realize how the training they receive in the seminars helps them to approach these methodologies in a better way.

Among the comments on the experience of the seminars, the following can be cited as the most significant: "The course focuses properly on the difficulties that college students have, and therefore the techniques provided are very useful"; "These courses seem to me to be very important"; and "Thanks to the skills I have acquired I now know myself better".

5.1.1.4 Training supported by online platforms (4th and 5th version)

Figure 8 show the results of the subsequent surveys of the face-to-face seminars that complemented the PaP online courses. Seminars on Intrapersonal Intelligence (27 students answered out of a total of 29), Interpersonal Intelligence (21 students out of 23), Coaching (19 out of 22) and Professional Skills (PS) (15 out of a total of 16) were performed from 2012 to 2014. Questions 8 to 11 were specific for each workshop subject being:

- Question 8: I have acquired tools to (Intra) understand myself more deeply, (Inter) know and understand people more deeply, (Coach) define my goals clearly, (PS) better organize my time and to be more productive.
- Question 9: I have acquired (Intra) emotional self-regulation tools to properly manage my moods, (Inter) tools to improve my social and communication skills, (Coach) Coaching tools to analyze from a broad perspective my situation, (PS) leadership and motivation tools to manage teams of people.
- Question 10: I have acquired (Intra) self-motivation tools to know and develop my motivations,

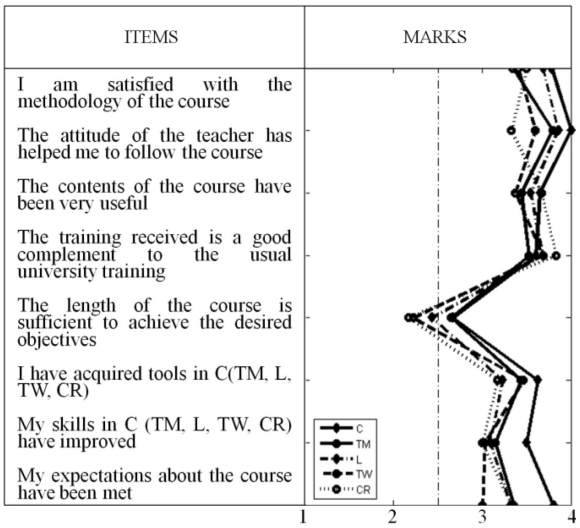

Fig. 7. Survey results of transversal competencies workshops performed from 2010 to 2012.

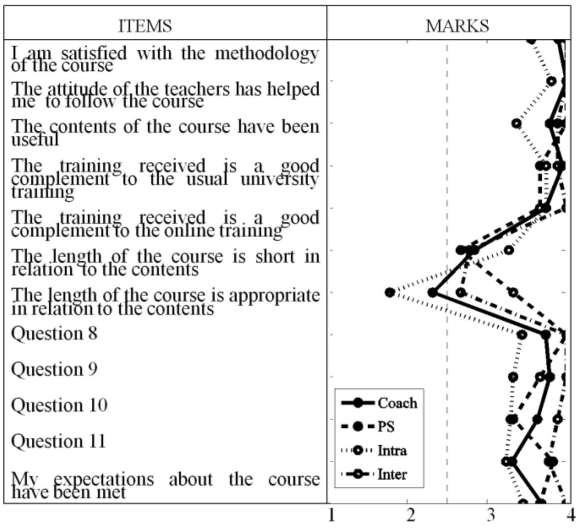

Fig. 8. Survey results of Intrapersonal, Interpersonal, Coaching and Professional Skills workshops performed from 2012 to 2014.

(Inter) interpersonal skills to improve my relationship, (Coach) Coaching tools for designing and tracking my action plans, (PS) negotiation tools to effectively resolve personal and professional conflicts.

- Question 11: (Intra) I have acquired knowledge and tools to promote my intrapersonal intelligence, (Inter) I have acquired knowledge and tools to promote my interpersonal intelligence, (Coach) I have acquired knowledge and tools to support others in achieving their goals, (PS) The training received improves my professional skills

Looking at the results, a particularly high valuation, close to 4, was given to the question ''The training received is a good complement to the university training'' and to the question regarding the tools acquired in the corresponding course subject. In any case, all items obtained ratings above 3. These workshops are held periodically as they are now included in the General Catalog of the UPM Degree Creditable Activities.

5.1.2 Research method 2: Pre-post evaluation using ''Constructive Thinking Inventory''

Next the results using the CTI test are described and discussed.

5.1.2.1 Overall results

This section contains the results obtained from 105 students (out of a total of 197 students attending the EI courses) enrolled in some versions of the project who completed both CTI test questionnaires. Regrettably, many students did not complete both evaluations, but the sample size is large enough. As the information in Fig. 9 reveals, there was a very favorable emotional development of the participants because the general indicator and the variables that should have increased did so (left side of figure) and the variables that should have decreased (right side of figure) also did so. Moreover, as can be seen in Table 7, a contrast of mean difference was performed for paired dependent samples in order to study the significance of the differences found in this pre-post study.

The CTI test provides one general indicator about the ''Global Constructive Thinking'' (GCT) of the evaluated students as well as other indicators related to their socio-emotional competencies that can be classified in five dimensions: emotional coping, behavioral coping, categorical thinking, esoteric thinking and optimism. After proper training these dimensions of EI should be as follows:

- For dimensions that should tend to higher scores, namely, emotional coping (corroborated with self-esteem, lack of negative overgeneralizations, hypersensitivity and ruminations about unpleasant experiences) and behavioral coping (corroborated with positive thinking, orientation to action and responsibility), the contrast of mean difference founds that, for all these variables, the p-value is less than 0.05. So, in all of them, the difference between the pre-test and post-test can be considered statistically significant.
- For dimensions that, after adequate training in EI, should tend to lower scores, that is, categorical thinking (polarized thinking, suspicion and intransigence), esoteric thinking (paranormal and superstitious beliefs) and optimism (exaggerated optimism, stereotypical thinking and ingenuity), the contrast of mean difference was also performed for paired dependent samples, and it founds that in this case the p-value is less than 0.05 for almost all of the variables. Therefore, the difference between the pre-post evaluations can be considered statistically significant, for all variables except for the following: esoteric thinking,

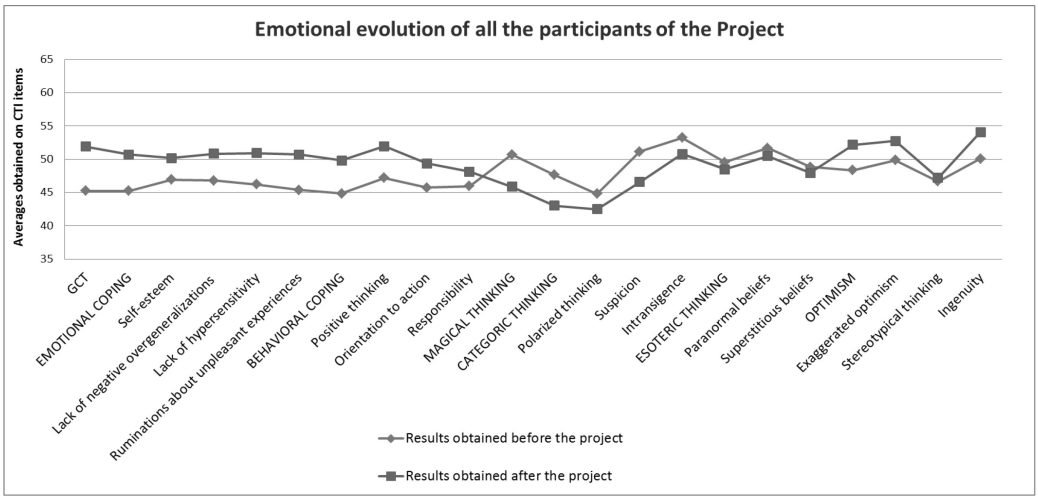

Fig. 9. Overall results of CTI pre-post study.

Table 7. Results of test of mean contrast for pre-post CTI of the evaluated students.

	Pre-evaluation	Post-Evaluation	Difference	p-value
0. Global Constructive Thinking *	45.14	52.10	6.95	3.30E-12
1. Emotional coping *	45.34	50.93	5.59	1.08E-10
1a. Self-esteem *	46.80	50.24	3.44	3.84E-05
1b. Lack of negative overgeneralizations *	46.90	51.16	4.25	6.74E-07
1c. Lack of hypersensitivity *	46.41	51.08	4.67	1.73E-09
1d. Lack of unpleasant ruminations *	45.51	51.01	5.49	5.84E-10
2. Behavioral coping *	44.71	49.82	5.11	2.13E-08
2a. Positive thinking *	46.79	51.73	4.93	2.23E-06
2b. Orientation to action *	45.76	49.54	3.78	1.73E-06
2c. Responsibility *	45.96	48.20	2.23	0.00740878
3A. Magical thinking *	50.31	45.24	–5.07	6.61E-08
3B. Categorical thinking *	47.68	42.63	–5.04	1.19E-08
3a. Polarized thinking *	45.05	42.44	–2.60	0.00059169
3b. Suspicion *	51.21	46.26	–4.94	8.75E-09
3c. Intransigence *	53.22	50.69	–2.53	0.00140769
4. Esoteric thinking	49.38	48.40	–0.97	0.10719901
4a. Paranormal beliefs	51.72	50.47	–1.24	0.06814706
4b. Superstitious beliefs	48.62	47.92	–0.70	0.19118485
5. Optimism *	48.38	52.22	3.84	1.58E-05
5a. Exaggerated optimism *	49.97	52.86	2.88	0.00118912
5b. Stereotypical thinking	46.84	47.02	0.17	0.42038687
5c. Ingenuity *	49.98	54.25	4.26	4.26E-06

(*) The *p*-value is less than the 0.05 level

paranormal beliefs, superstitious thinking and stereotyped thinking. It is worth noting that the variables relating to optimism grew, which could be interpreted as an increase in unjustified illusion and irrationality. This might be true if the variables referring to magical or esoteric thinking had also increased, but for these variables the contrast results were not concluding and the increment in optimism seems innocuous.

In conclusion, the results obtained by this research method have been very favorable and show objectively the impact that the project has had on the development of the participants socio-emotional competencies, which increased their GCT by 6.95 points (*p*-value: 3,30E-12) and almost all the EI dimensions changed as expected.

5.1.2.2. Results by academic course

As mentioned above, students from different academic stages constituted the target audience across the project versions. The results obtained with students from the first, second and later academic courses of several schools reveal favorable evolutions, but noteworthy differences between the diverse collectives' evolutions have been found. These differences may be due to various reasons, such as the level of maturity of the students of each academic course or the training configuration of the project version where the student was enrolled (see Table 3). As shown in Fig. 10, the results in every project version follow the same pattern.

The 27 first-year students of the 09–10 version improved their score (almost 5 points in the GCT) but the first measurement reveals a low starting point probably due to their age and the changing situations new engineering students have to deal with. In versions 10–11 and 11–12, the 45 second- and final-year students started in a better situation than the previous ones and they improved their scores (around 10 points in the GCT) to the best levels of the project. That could be explained because the training program offered in these project versions was the most complete (including EI seminars, coaching processes and Transversal Competence Workshops) as well as the more favorable starting point of the participants. In the version 12–13, 33 students from all academic courses started in an intermediate situation and improved their scores (around 6 points in the GCT) by taking part in training programs based on online learning and EI seminars.

The contrast of mean difference was calculated for paired dependent samples in order to study the significance of the differences found in this pre-post study in every academic course and the resulting information supports the previous argument. In each course, the *p*-value obtained for the main indicators expected to increase (Global Constructive Thinking, Emotional Coping and Behavioral coping) is less than 0.05 and consequently the identified increments are statically significant. Furthermore, the *p*-value for the main indicators expected to decrease (Magical thinking, Categorical thinking and Esoteric thinking) is also less than 0.05 in most cases, and so the identified decrements are statically significant. The increment of the last main indicator (optimism), which should decrease

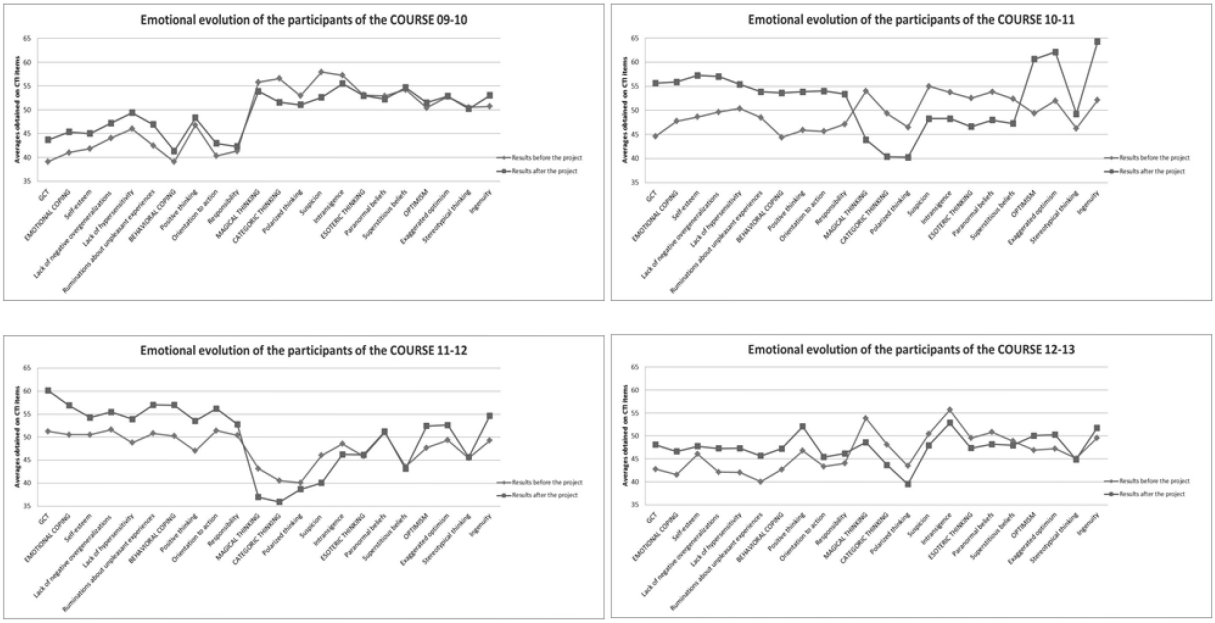

Fig. 10. Results of CTI pre-post study per academic year (*Results of the course* 11–12 *have been taken from* [24]).

according to some authors, is significant at the 0.05 level in almost every academic course, but it is not necessarily negative, as explained above.

5.1.3 Research method 3: Study with an additional instrument for the students' evaluation

In the last version of the project one study related to the influence of EI training on student motivation was carried out using the Motivational Diagnosis Instrument for Engineering Education (MDI-EE) [27]. It is based on theories or models from 6 motivation experts (McClelland, Adams, McGregor, Vroom, Locke, Herzberg), and consists of 7 motivational areas adapted to Engineering Education. This instrument explores the engineering students' motivation through their motivational needs, the rewards received, the effort required, their work attitude, their expectations, their activity performance under different parameters and several intrinsic and extrinsic elements. The MDI-EE was completed by 152 students categorized in two groups: 60 students who performed blended training in EI, including motivation aspects, and another 92 students who did not perform training in EI, which acted as a control group. As presented in [27], the students trained in EI increased their motivation in comparison with the untrained students, as follows:

- They cultivated greater levels of intrinsic motivation, becoming more prone to challenges, participation and autonomy.
- They were highly sensitive to the shortcomings of their environment, becoming slightly more critical of the relationship between effort and reward.

5.1.4 Student method triangulation

By combining the results obtained using the different research methods adopted with the students in the project some of the distinguishing elements that participating students have developed and which have contributed to increasing their academic performance, as well as their professional competitiveness, can be studied. Below, the project's impact on some key socio-emotional competencies is discussed:

- Self-awareness and self-regulation: the engineering students who have participated in the project tolerate frustration better and manage their stress more appropriately. By examining the results obtained in the CTI, it can be seen that variables that favor capabilities such as positive thinking, orientation to action and absence of negative generalizations, have increased, while others, which are prejudicial, such as suspicion or intransigence have decreased. This, together with the results of the surveys, which show a positive self-perception of development in items such as flexibility to deal with changes, security, worth and inner confidence or the ability to manage time, indicate that the ability of the participants to manage stress and frustration has improved. The development of this emotional dimension is crucial for the success of engineering students because it can optimize their academic performance and, especially in the case of first-year

students, contribute to decreasing the risk of dropping out. Furthermore, these abilities will be useful for the students in their professional future.

- Motivation: the engineering students enrolled in the project now exploit better their ability to self-motivate and are proactive in the challenges they undertake. By observing the results obtained in the CTI, it is found that variables that favor these capabilities, such as self-esteem, orientation to action, responsibility, optimism and absence of negative overgeneralizations, have increased. This, together with the results of the surveys, where there is a positive self-perception of the development of items such as motivation to study, attitude in class, management of changes or security, worth and inner confidence, indicate a motivational improvement. Moreover, the results obtained by applying the MDI-EE tool reveal that the students trained in socio-emotional skills increase their motivation in a more favorable way than non-trained students. The development of the motivational dimension is key for engineering students because it contributes to improving their academic performance and their professional future, as well as decreasing the risk of dropping out.
- Social skills and empathy: the participating students are now more cooperative and work better together. The CTI results indicate that variables that promote teamwork, such as self-esteem, orientation to action, responsibility or absence of negative overgeneralizations and unpleasant ruminations have increased, while prejudicial variables, such as suspicion and intransigence, have decreased. This, together with the positive self-perception of the development of flexibility, listening, empathy, social skills and team work, shows that the ability to work cooperatively of participants has improved. The development of the dimensions of communication and teamwork are critical for academic performance and the professional success of engineering students since they normally have many cooperative activities in their engineering degrees and their professional career will require them to interact with coworkers, users, clients, etc.

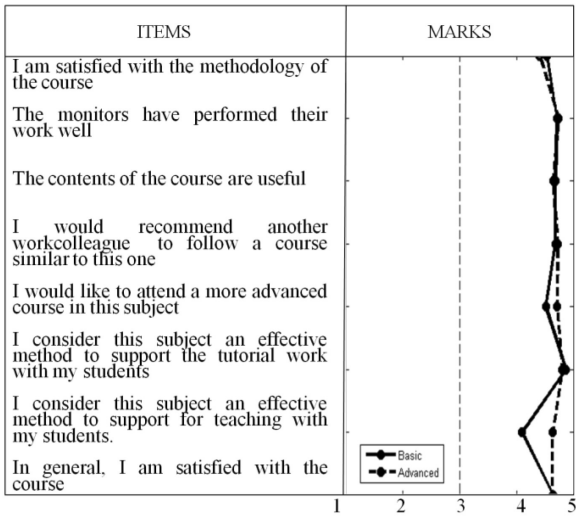

Fig. 11. Survey results of Coaching courses for professors performed from 2009 to 2013.

5.2 Results obtained with the professors

In this section the results obtained with the instruments and approaches used with the professors are described and discussed.

5.2.1 Research method 1: Evaluation using ad-hoc surveys

Throughout the project we conducted 7 workshops for professors: 3 basic and 4 advanced, with 135 teachers attending in total. After each workshop, all the participants filled out an ad-hoc survey. Fig. 11 shows the results of those surveys. As can be observed, no analysis per academic course has been done in the teachers' case as the sample of participating professors during the project was relatively homogeneous.

The most relevant items related to the research questions raised in this section are those that measure the usefulness of the course content, the consideration of the EI and Coaching techniques as being effective in teaching and tutorial work with the students, and the desire to continue learning in these subjects. It is noteworthy that the teachers consider this kind of training more useful for tutorials than for the teaching in their classes. This can be explained because in most of the UPM degree courses the number of students per class is high, so it is more difficult to make use of these methodologies than in tutorials, where the relationship with the students is closer.

Furthermore, at the end of every post-course survey, professors could write some comments about any issue that was not dealt with in the previous items. The following comments are representative: "I think all teachers should do a course like this as it is extremely useful"; "I would like to continue attending new courses to reinforce what I have learnt"; "All subjects very interesting, I'm looking forward to implementing them" or "Excellent initiative, keep it up!".

5.2.2 Research method 2: Multi-subjective evaluation by their own students

Table 8 and Fig. 12 show in a numerical and graphical way, respectively, the answers-scores given by the students in the TESS instrument

Table 8. Results of test of mean contrast for the answers-scores given by the students about their trained and untrained teachers in EI or Coaching

Related to		Question	Untrained	Trained	Difference	p-value
Motivation in the classroom	1	The teacher shows enthusiasm for the subject that he/she explains*	8.16	9.12	0.95	0.0020
	2	The teacher tries to capture the attention of students in class*	7.53	8.35	0.82	4.1471e-10
	3	The teacher is aware of the needs of the class (tiredness, overlaps with other subjects, etc.)*	6.93	7.95	1.02	1.1072e-12
	4	The teacher uses a wide variety of techniques to transmit his knowledge: written text, images, diagrams, intonations of voice, appropriate body language, etc.*	7.12	7.57	0.44	0.0011
	5	The teacher usually highlights the usefulness of each of the subjects studied	7.43	7.57	0.13	0.1634
	6	The teacher told us about the importance and utility of the subject in the educational and professional context	7.07	7.1980	0.11	0.2139
	7	In general, the teacher′s attitude motivates me to study more*	7.27	7.81	0.53	0.0283
Talent Management	8	The teacher usually realizes if something is very difficult or very easy for the students, he adapts his explanations to our level accordingly*	7.00	8.02	1.01	6.1052e-12
	9	The teacher knows how to adapt his communication style to the needs of the class (i.e., he is empathetic if he wants to know our concerns and difficulties, he is authoritarian if he wants to mark any limit, he is democratic if he wants to involve the class in a decision, etc.)*	7.21	7.99	0.78	6.5082e-9
Help Relationship	10	The teacher tries to learn the name of the students and addresses them by their name*	5.52	8.48	2.96	0
	11	When I ask the teacher something, I feel he/she listens to me *	8.10	8.84	0.73	1.4606e-10
	12	The atmosphere in class makes me feel that I may ask without fear of being ridiculed*	7.94	8.63	0.69	2.4640e-9
	13	The teacher is patient with me when I ask questions*	8.08	8.74	0.65	2.8874e-9
	14	I feel that it matters to the teacher if I pass or fail the subject*	6.89	7.85	0.96	1.1054e-8
	15	I feel the teacher makes an effort so that the students learn and pass the subject*	7.65	8.37	0.71	2.7399e-8
Time Management	16	The teacher prepares the class in an ordered and sequential way	7.81	7.83	0.02	0.4424
	17	The teacher is usually punctual, starting and finishing the class on time	8.14	8.16	0.01	0.4579
	18	The teacher correctly distributes the class time and he/she does not have to rush at the end	7.44	7.71	0.26	0.0548
Action Plan	19	The teacher shows us the opportunities the university offers to study the subject (tutorials, laboratories, libraries, learning resources, etc.)*	7.05	7.57	0.51	2.4758e-4
	20	The attitude of the teacher helps me to use my skills to deal with the subject	7.46	7.75	0.29	0.1551
	21	The teacher supports me to overcome the difficulties I have in the subject*	7.08	7.74	0.65	1.1538e-6
	22	The teacher follows how our knowledge of the subject evolves throughout the semester*	6.39	7.43	1.03	3.5160e-10
	23	In general I feel that the teacher has confidence in my abilities to pass the subject*	6.90	7.65	0.75	1.8170e-7
Frame	24	At the beginning of the semester the teacher showed us the themes that we were going to study in the subject*	7.66	8.08	0.41	0.0045
	25	At the beginning of the semester the professor introduced us to the evaluation criteria which are clear and objective*	7.69	8.45	0.75	1.9842e-6
	26	In the learning guide are listed the learning and documentary resources needed to follow the subject*	7.53	8.17	0.64	4.3868e-6
Global	27	Overall, the work of the teacher has positively influenced my learning*	7.76	8.33	0.56	5.6560e-5

(*) The *p*-value is less than the 0.05 level.

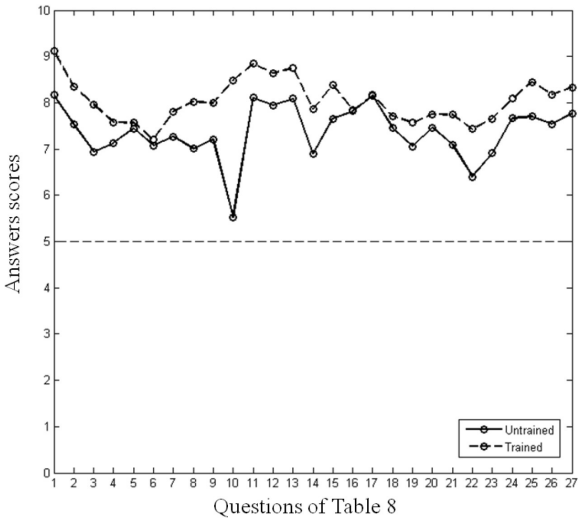

Fig. 12. Differences between the performance of professors trained and untrained in EI & Coaching.

about their professor's emotional skills for teachers who had attended one or more seminars in the project (a total of 16 teachers and 293 student answers) and a control group of teachers who had not previously received any training either in EI or Coaching (a total of 14 teachers and 356 student answers). A contrast of mean difference was performed for paired dependent samples in order to study the significance of the differences found in this comparison study. The first thing that can be noticed is the medium-high level at which both groups of teachers are valued. However, in most of the evaluated items (21 of 27), trained teachers obtained scores significant (the *p*-value is less than 0.05) higher than non-trained ones.

The trained teachers score significantly higher in almost all TESS areas. The abilities of the professors to motivate their students, manage their talent, and create helpful relationships oriented to an action plan where the frame is clearly defined are much more appreciated in the teachers who participate in the aforementioned training programs. In the following aspects, several differences have been found between both groups. It seems that empathy with the needs of the class, the listening abilities of the teacher, and the adaptation in terms of communication style and explanation level (questions 3, 8, 9 and 11) are more appreciated by the students of the trained teachers. Furthermore, students also feel that the teacher cares about whether they pass or fail the course and he/she helps them to overcome the difficulties by means of appropriate monitoring throughout the semester in order to know how their knowledge evolves (questions 14, 21 and 22). All of this contributes to establishing relationships and creating an atmosphere where the professors explain their subject with enthusiasm, keep the attention of the students and enhance their motivation (questions 1, 2 and 7). Lastly, the biggest difference (of almost three points) is shown on the effort made by the teacher to call students by name (question 10); this aspect may be due to the ignorance about the importance of calling students by name and also because the classes are numerous in many degrees of the UPM making it difficult to memorize the name of the students.

All these aspects have been dealt with in depth in the training provided to the teachers, where the techniques normally used by EI facilitators [4, 5] and professional coaches [6] to create a climate of trust, have been adapted to engineering teaching. In this sense, it is reasonable to think that the differences mentioned between both teacher groups are due to the impact of the training programs presented because they provide a solid basis to expect, on average, some improvements to occur in the teachers' socio-emotional skills. However, this cannot be guaranteed because of the fact that the teachers attended the seminars voluntarily, which may bias the sample since perhaps the interest of the teachers in training in these techniques involves a greater starting level of emotional skills. Due to this sample limitation, it cannot be guaranteed that the higher scores of the trained groups were caused solely by the training itself, or by the teacher population that was attracted to it, but, most probably, by a combination of the two.

5.2.3 Professor method triangulation

The connection between the considerations made by professors in the survey after each training seminar and the answers given by their students through the TESS can be studied in terms of class and tutorial behavior:

- The teaching of the professors is enhanced with EI and Coaching training. Teachers consider the EI and Coaching techniques effective in teaching and their students feel that empathy with the needs of the class and the adaptation in terms of communication style and explanation level are higher in trained teachers.
- Trained teachers develop better tutorial work: professors consider this kind of training especially useful for tutorials and their students also say that trained teachers care about whether they pass or fail the course and perform appropriate monitoring throughout the semester to a greater extent than untrained teachers in order to know how their knowledge evolves.

Regarding other research carried out into absenteeism and dropping out, the relationship between this issue and the socio-emotional development of the teacher can be examined. As part of the effort that

the UPM is making to analyse the causes and prevent first-year students abandoning their courses, the transversal EIP "Analysis of absenteeism and dropping out of undergraduate degrees at the UPM", was carried out in the course 2011–12. This EIP dealt with, among others, the identification and selection of teaching practices that can contribute to reducing absenteeism and subsequent dropping out. A large group of teachers who had a low rate of absenteeism in their classes were interviewed in order to find a set of actions that teachers used to motivate learning and to select a "Decalogue of practices" [23] that covers the actions (activities, attitudes, etc.) most used and valued by these "star" teachers. All were related to teacher communication skills (enthusiasm, attracting attention, subject presentation), with the atmosphere created in class (respect, trust, to pass with reasonable effort) and the information offered to them (resources and evaluation criteria). So this "Decalogue of practices" is closely related to the actions most appreciated by the students in the study performed with the TESS test.

6. Answers to the research questions

The research instruments used to evaluate the impact of the training (see Section 4) have revealed good results (see Section 5) which allow empirical answers to be given to the research questions, as it can be observed in Table 9.

7. Conclusions

In general, the well-established findings related to the importance of socio-emotional competencies in Engineering Education [10–16] have been confirmed: student Emotional Intelligence can be strengthened with proper training; emotional competencies can assist an engineering student to have a successful university education experience and help the graduating student is a desirable employee on the labor market.

More specifically, the research results obtained reveal that the engineering students found in the socio-emotional training a very good and useful complement to their traditional education. Their

Table 9. Answers provided to the arisen Research Questions

Research Question	Answer
Students	
RQ1: Are the EI and Coaching disciplines a good complement to traditional university education?	Looking at the positive opinion of the students trained in the use of the EI and Coaching disciplines, as well as at the improvement achieved in their socio-emotional skills, it can be said that these are good complements to the traditional education.
RQ2: What training possibilities can be used to favor the students' socio-emotional skills?	EI seminars accompanied by Coaching processes, workshops on specific transversal competences, and blended and online training programs.
RQ3: What research instruments can be used to evaluate the students' development?	Ad-hoc surveys, 360º web applications, consolidated tests such as CTI or MSCEIT, or new instruments like MDI-EE. Also, comparison and pre-post strategies can be adopted to facilitate the inference making processes.
RQ4: Is it possible to increase the students' emotional quotient through fundamentally experiential EI training with the help of Coaching techniques? (RQ4A). If so, is it possible to quantify, in terms of indicators and competencies, how relevant the increase could be? (RQ4B)	By using a pre-post strategy with the CTI instrument, the increment of the students' emotional quotient and its related indicators have been corroborated (for more details, see Fig. 9)
Professors	
RQ5: Do the EI and Coaching disciplines provide effective methods for engineering educators?	Looking at the positive opinion of the trained professors about the effectivity of the EI and Coaching methods for their teaching and tutorial activities, as well as at the greater estimation given by the students to the socio-emotional performance of the trained professors, it can be said that these methods are effective for Engineering Education.
RQ6: What training possibilities can be used to favor the teachers' socio-emotional skills?	Face-to-face seminars about EI & Coaching techniques for Engineering Education, leveled in different stages. Also, Coaching processes and online training programs.
RQ7: What research instruments can be used to evaluate the teachers' development?	Ad-hoc surveys, 360º web applications, consolidated tests such as CTI or MSCEIT, or new instruments, e.g. TESS. Also, comparison and pre-post strategies can be adopted to facilitate the inference making processes.
RQ8: According to the students' perception, are there differences in the teachers' performance in terms of socio-emotional skills between the teachers trained in EI and Coaching and those not? (RQ8A). If so, what are these performance differences? (RQ8B)	The socio-emotional performance of teachers trained in EI & Coaching techniques is more appreciated by their students than that of untrained ones (For more details, see Table 8).

EI general indicator (GCT) has increased significantly due to the increase in the emotional and behavioral coping dimensions and the decrease in the magical and esoteric thinking dimensions. The students have strengthened their constructive thinking and self-esteem, have increased their responsibility and proactivity and have decreased their intolerance and mental rigidity.

Besides, engineering professors found in the disciplines of EI and Coaching innovative and effective techniques to support their teaching and tutorial work. Moreover, the study based on multi-subjective approaches shows that students perceived more positively the socio-emotional behaviors of the professors trained in the EI and Coaching disciplines than the untrained ones.

Furthermore, engineering universities can support the socio-emotional development of their community using different training techniques and strategies, from face-to-face, extensive seminars accompanied by individualized Coaching processes, to massive online approaches complemented by additional face-to-face workshops. The most experiential and individualized training approaches lead to the best results, however it uses up a lot of resources and its scope is very limited considering the huge number of students and workers that universities typically have. The online approaches also provide good results, especially if they are complemented with face-to-face workshops (blended learning), and they can have a more extensive scope and open up new possibilities.

Finally, in terms of the future work related to the project presented, the following is worthy of mention: The diffusion and promotion of the online and blended learning continues actively in order to ensure that a constant flow of the UPM students and workers develop their socio-emotional competencies. New online learning possibilities related with 360-evaluation and recommendation mechanisms are being designed in order to promote the active learning of the online learners. And finally, research studies framed in a European Consortium of Universities context will be proposed to extend the benefits of the project, to strengthen the conclusions obtained and to continue providing findings for Engineering Education.

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