Article

Soft and Transferable Skills Acquisition through Organizing a Doctoral Conference

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Abstract: This article presents a 10-year experience of soft and transferable skills acquisition through the involvement of PhD students in the organization of an international conference. Soft and transferable skills acquisition is currently perceived as a core component of doctoral studies. Examples include writing and communication, teamwork, time management, leadership, resource management, negotiation, problem solving, listening, planning, entrepreneurial spirit, mastering ethics awareness, etc. The need for such skills is due to the leading role that doctoral students are expected to play in society. As such, various organizations have issued recommendations for doctoral programs to include a formal component of soft skills training. In this article, an effective way of introducing soft and transferable skills acquisition in doctoral engineering education is introduced. Namely, a form of collaborative project-based learning is designed as a compulsory course. This includes a set of base lectures, a long period of parallel working groups focusing on the various aspects of organizing an international conference, running the actual conference, and performing a post-conference assessment. Results and lessons learned demonstrate the validity and effectiveness of the proposed approach.

Keywords: soft skills; doctoral education; project-based learning; group work; doctoral conference

1. Introduction

The structure and content of doctoral programs in engineering have faced a considerable evolution in the last decade [1–3]. There is an increasing concern around the quality and efficiency of the training process, which has led to progress on monitoring mechanisms and a move from training based exclusively on the traditional student–supervisor relationship to "structured doctoral" training, featuring a combination of formal courses, often in the first year, with the usual research and thesis development phases.

Of relevance is the recognition of the importance of soft and transferable skills in doctoral education [2] such as interpersonal relationship capabilities and skills that can be transferred between jobs and functions. This includes, among others, writing and communication, networking and teamwork, time management, leadership, resource management, negotiation, problem solving, listening, planning, entrepreneurial spirit, mastering ethics awareness, etc. Often, PhD students tend to be so focused on acquiring specific technical skills in their field that they neglect the importance of also acquiring these other skills that are crucial in a competitive job market. To overcome this situation, entities such as the European Universities Association or the Marie Sklodowska Curie program of the European Commission have been recommending and pushing for the inclusion of explicit training on soft and transferable skills in doctoral programs [4]. These recommendations have been progressively adopted, at varying degrees, by many programs [5,6], as is the case of the PhD program on Electrical and Computer Engineering of the Faculty of Sciences and Technology of the Nova University of Lisbon.

A challenge is to devise practical ways of introducing such training in formal education programs as engineering students tend to be not very motivated for these issues [7,8]. Therefore, the research question addressed in this work is: "What can be a practical and effective way of introducing soft and transferable skills acquisition in a doctoral engineering program?"

To address this question, one of the instruments used in our PhD program is the mandatory engagement of students in the full process of planning and organizing an international conference. Part of the motivation is that future doctors, along their professional careers, will most likely be involved in the organization of international technical events, thus making it relevant to learn the process and understand the involved challenges, roles, and stakeholders. Additionally, the organization of a conference, if well planned, provides the opportunity for hands-on acquisition of a variety of soft and transferable skills. It is, thus, a kind of project-based learning (PBL) through which students gain skills by working for an extended period on a practical challenge. In our PhD program, these activities are carried out under the scope of a formal and compulsory course entitled "Doctoral Conference", which spans along one year, culminating with the realization of a real conference—The Advanced Doctoral Conference on Computing, Electrical, and Industrial Systems (DoCEIS). This course is aligned with the Bologna Declaration, contributing to the implementation of the European Higher Education Area, which promotes the adoption of active learning methodologies.

This article reports on and analyzes a long-term 10-year experience with this initiative, which has proven highly beneficial for the education of PhD students. The adopted model is described, and the lessons learned are discussed. Therefore, the remainder of the article is organized as follows: Section 2 introduces the conference course model and its core characteristics; Section 3 briefly describes the method adopted in this study, including relevant data; Section 4 discusses the main findings, including the positive aspects of the model as well as its limitations. Finally, conclusions are drawn in Section 5.

2. DoCEIS Conference Model

2.1. Structure of the Conference

In recent years, there has been a proliferation of doctoral conferences/symposia, either as satellite events of other conferences, or as autonomous events. Table 1 shows some examples. Most of them focus on one relatively narrow topic, often associated with one conference series or with one professional society.

Table 1. A sample of doctoral conferences.

Event	Autonomous/ Satellite	Full Papers/ Summary	Formal/Local Proceedings	Indexing	Sponsors	Regular/Sporadic
BSC International Doctoral Symposium	A	S	L	?	-	R (>2014)
DCE Doctoral Congress in Engineering	A	S	NA	-	-	R? (>2015)
DoCEIS—Doctoral Conf on Computing, Electrical and Industrial Systems	A	F	F	WoS, Scopus, DBLP	IFIP, IEEE-IES, Socolnet	R (>2010)
ECOOP Doctoral Symposium	S (ECOOP)	S	NA	?	-	R (>1991?)
HEALTHINF Doctoral Consortium	S (HEALTHINF)	S	L	-	INSTIC	R (>2014?)
ICGSE Doctoral Symposium	S (ICGSE)	S	IEEE	?	(IEEE-CS)	R/>2008?)
ICSE Doctoral Symposium	S (ICSE)	S	L (+ACM Digital Lib)	?		R (>2011)
ISCRAM Doctoral Symposium	S (ISCRAM)	S	NA	-	-	S ?
ISSRE Doctoral Symposium	S (ISSRE)	S	IEEE	?	IEEE	R (>2015)
SDIA—Doctoral Symposium on AI	S (EPIA)	F	L	?	APPIA	R (>2009)

Table 1. *Cont.*

Event	Autonomous/ Satellite	Full Papers/ Summary	Formal/Local Proceedings	Indexing	Sponsors	Regular/Sporadic
PRIME—Conference on PhD Research in Microelectronics and Electronics	A	F	IEEE	?	IEEE-CAS	R (>2003)
SEDES—Portuguese Software Engineering Doctoral Symposium	S (several)	F	L (+IEEE, IARIA, …)	?	-	S (>2004)

?: unclear or unavailable information.

DoCEIS has various distinctive characteristics which give it some degree of uniqueness. It runs as an autonomous event, and since its first edition, it has aimed at being a full-fledged international conference pursuing the following objectives:

- Ensure high quality through the support of an International Program Committee composed of well-recognized professors and the technical co-sponsorship of international organizations, namely IEEE Industrial Electronics Society, International Federation for Information Processing (IFIP), through its WG 5.5, and the SOCOLNET—Society of Collaborative Networks;
- Apply a strict evaluation of contributions, through double-blind reviewing of full papers;
- Have formal proceedings. In all editions, proceedings were published as a book by Springer, and indexed in the Web of Science, SCOPUS, and DBLP.

Furthermore, being organized as a formal course of the PhD program creates a higher level of commitment of all students involved in the organization in comparison to other more informal events. As reflected in the title, DoCEIS targets students from electrical and computer engineering, computer science, and industrial engineering. Given this wide scope, for each edition, a leading theme is chosen (see Table 2).

Table 2. Leading themes.

2010	Emerging Trends in technological Innovation
2011	Technological Innovation for Sustainability
2012	Technological Innovation for Value Creation
2013	Technological Innovation for Internet of Things
2014	Technological Innovation for Collective Awareness Systems
2015	Technological Innovation for Cloud-based Engineering Systems
2016	Technological Innovation for Cyber-Physical Systems
2017	Technological Innovation for Smart Systems
2018	Technological Innovation for Resilient Systems
2019	Technological Innovation for Industry and Service Systems

The selection of the main theme aims at being:

- A theme to which all participating PhD students could relate, independently of their specialization area (a kind of "unifying element");
- Appealing and appropriate as a title for the proceedings book;
- A motivation for multidisciplinary discussions during the conference.

All authors are then "challenged to look beyond their specific research question and relate their work to the selected theme of the conference namely, to identify in which ways their research topics can benefit from or contribute" to this theme [9]. This is done through the inclusion of one specific mandatory section in each paper. Having recognized formal proceedings contributes to the students' need to publish their PhD work [10].

In addition to the submitted contributions, DoCEIS includes several other activities, some of them usual in any conference, others with a flavor of "summer school", such as:

- Invited keynotes;
- Panels, either on technical or PhD education related issues (e.g., employment opportunities for young doctors, role of doctors in industry);
- Tutorials on topics such as research ethics, communicating science, design thinking, leadership, getting published in journals, intellectual property rights, building social professional networks, etc.;
- Technical sessions involving hands-on experiments and discussion, e.g., electricity markets and intelligent agents, wireless architectures for IoT, Petri nets, smart manufacturing;
- Dialogue sessions, to discuss research questions and hypotheses of PhD students in the early stage of their programs.

2.2. Structure of the Course

The Doctoral Conference course is organized as follows:

- An initial set of lectures, to provide a general overview of the different types of conferences and technical events, as well as a detailed description of the involved processes and actors;
- Parallel working groups, to perform the organizational tasks along the year. Students are typically divided into 4 groups: technical program, associated activities, organizational logistics, and financial-related activities. Each group is mentored by an experienced professor;
- Periodic synchronization meetings, where each group summarizes their work status and discusses dependencies from other groups;
- Running the conference during the 3 days of the event;
- Closing and reporting, including all post-event activities and preparation of an individual report on the process of organizing a conference and lessons learned.

The process combines collaboration and PBL [11,12], ending in a final "product", the DoCEIS conference. It is a case of learning-by-doing activities and action-based entrepreneurship [13]. In addition to the typical requirements for effective teamwork [14] inside each group, another level of complexity is introduced by the need of intergroup collaboration. The four working groups need to collaborate, namely, to share information, synchronize activities, solve dependencies, and even work together on some occasions, in order to achieve the common global goal of running a successful doctoral conference. As such, this "project" is developed by a multiteam collaborative network [15,16]. Furthermore, during the conference days, the PhD students continue to be the main actors, namely taking care of the secretariat, managing logistics, interacting with hosting and social events entities, and chairing technical sessions, while the professors only play a supervision role in the background. This leads to an effective learning of the involved processes and practice leadership roles.

Figure 1 shows how the Doctoral Conference course relates to the rest of the PhD program. Particularly in what relates to soft and transferable skills, training on such topics is also complemented with the courses of Scientific Research Methodologies, and Techniques and Entrepreneurship Methods.

Spring time is the chosen period for the realization of the conference. As the preparation of a conference spans for almost the whole year, the Doctoral Conference course has been prepared considering the second semester of the first year and the first semester of the second year. This schedule is also convenient for preparation of the technical contributions from PhD students (either as full paper, or poster).
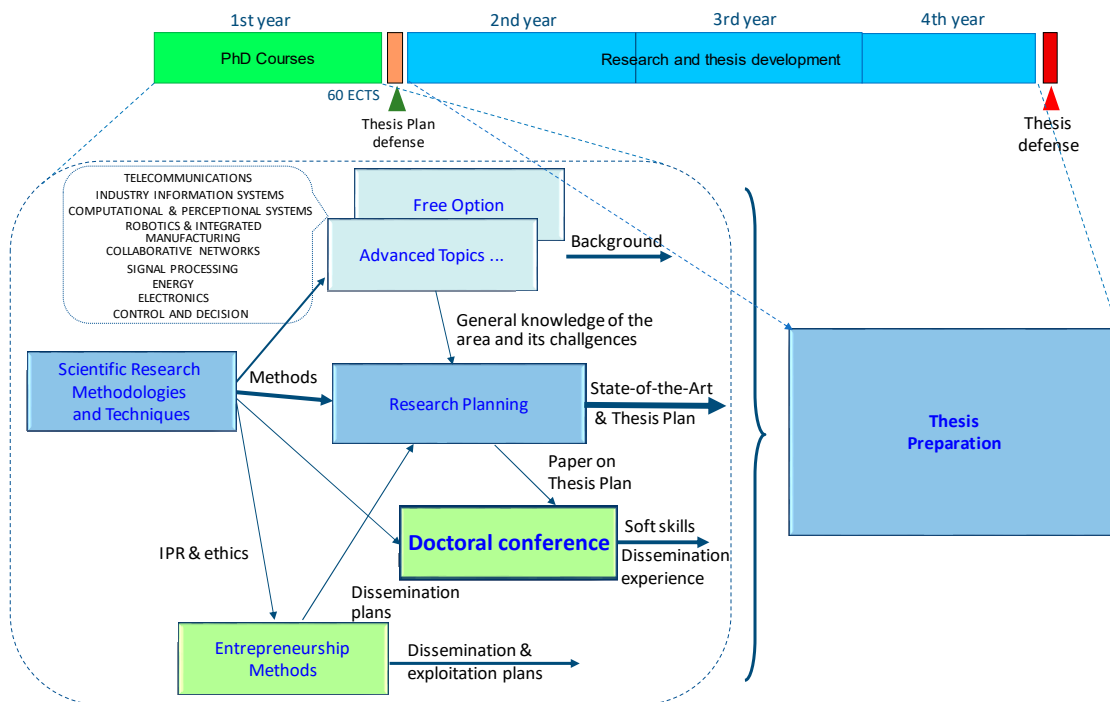
Figure 1. Positioning of "Doctoral Conference" course in the PhD program.

3. Study Method

From a methodological perspective, this work has the nature of a case study (Case and Light, 2011); therefore, findings in this article are based on a 10-year experience period. Over this period, we collected feedback from various sources, including (1) the PhD students involved in the organization of the conference, who had to deliver formal reports, (2) the professors that supervised and graded the students of this course, (3) the attendees (through questionnaires), and (4) some bibliometric data on the proceedings. Such data sets constitute the basis for our analysis.

The structure of the individual students' reports includes various assessment elements, namely on adopted methods, lessons learned, social networking, teamwork, and global evaluation (Table 3).

Table 3. Structure of the individual assessment and reflection reports by PhD students.

Individual Assessment Report Items	Expected Content
1 INTRODUCTION	Brief description of the purpose and goals of the doctoral conference course
2 THE PROCESS OF ORGANIZING A CONFERENCE 2.1 Full Process 2.1.1 Main Program group 2.1.2 Associated Activities group 2.1.3 Financial Aspects group 2.1.4 Organizational Logistics group 2.2 Details of Participant's Group	This section should summarize the process of organizing an international conference. As each student is involved in one group, naturally, it is expected that the activities carried out in that group be discussed in more detail (section 2.2). However, the objective is that each student acquires a "full picture" of the process, and thus, the activities carried out in the various groups need to also be summarized and discussed.
3 ACQUIRED EXPERIENCE 3.1 Lessons learned 3.2 Synthesis of main ideas at conference	This section is intended to summarize all important lessons learned, both from the soft and transferable skills side as well as from the scientific/technical side. The section should include positive and negative findings, as well as recommendations for improvement.

Table 3. *Cont.*

Individual Assessment Report Items	Expected Content
4 SOCIAL NETWORKING ACHIEVEMENTS 4.1 Examples of interactions/contacts 4.2 An idea for a follow up collaboration	Students are asked to briefly report on about 5 interactions with participants from other universities (in order to improve their professional social network). They are also asked to report on a potential follow up collaborative initiative resulting from those established contacts.
5 OTHER ASPECTS	This is an optional section to cover any relevant issues not addressed in the other sections.
6 CONCLUSIONS	Students are asked to summarize here the main conclusions about their experience in the conference organization and to make an overall assessment of that experience.
REFERENCES	
ANNEXES	Optional part.

Given that the authors of this article have accompanied the successive groups of students along the various editions of the program, elements of ethnographic research [17] have also been used to collect and analyze data.

A total of 117 PhD students, enrolled in our Doctoral Program in the period 2010–2019, have gone through this training process (Figure 2).
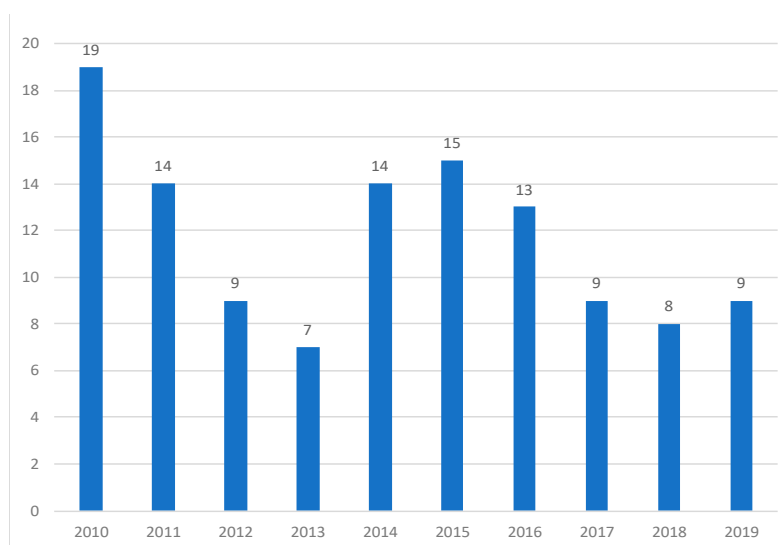

Figure 2. Trained PhD students.

Naturally, the number of students involved each year in the organization of DoCEIS depends on the number of students admitted into our PhD program.

Figure 3 shows the number of paper submissions to each edition of DoCEIS and countries of origin of their authors.
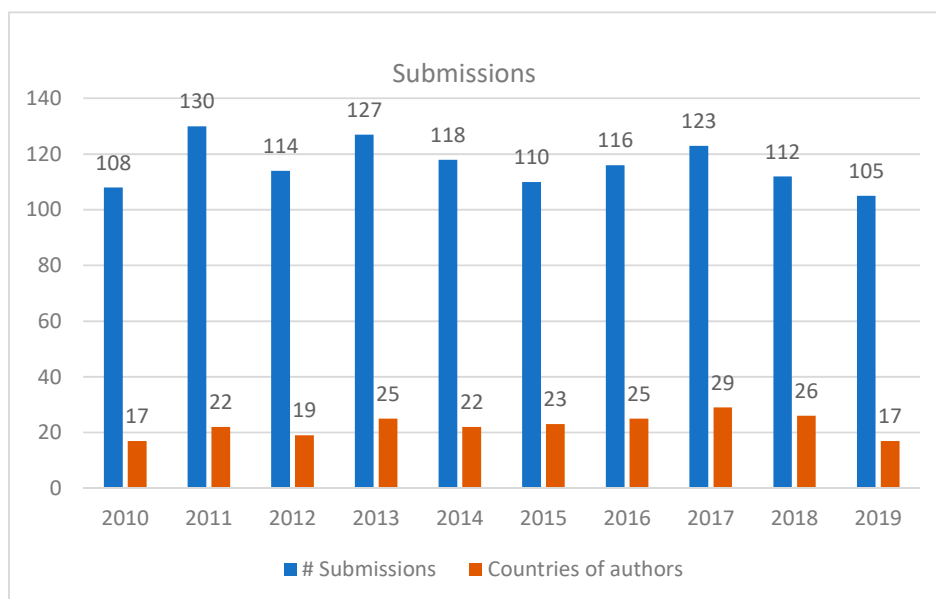
Figure 3. Number of submissions and countries.

The conference typically attracts, in average, over 110 submissions from around 25 countries, with these numbers remaining relatively stable. It is required that the first author of each submission be a PhD student. The supervisors and possibly other contributors appear as co-authors. PhD students are also required to be the ones presenting the papers.

In terms of attendance, DoCEIS editions count several participants, between 80 and 100, most of them PhD students. External participants do not benefit as much as the students engaged in the organization in terms of skills acquisition. Nevertheless, some contribution to their training in soft and transferable skills is also provided by the associated activities included in the conference program.

Some of the external attendees have also been invited to co-chair sessions, participate in panels on young researchers' views of technological innovation, and strongly encouraged to participate in intense interdisciplinary dialogue. Various pieces of feedback have been collected from them along the various editions, either directly via questionnaires, or indirectly via the interactions reported by the PhD students involved in the Doctoral Conference course.

Results presented in the next section represent a synthesis of the findings extracted from the mentioned sources, which include some quantitative but mostly qualitative elements. To cope with privacy principles, pseudonymization and anonymization mechanisms are applied to collected data. Additionally, the exceptions of art. 89 of GDPR [18] regarding research are considered.

4. Results and Discussion

4.1. Overall Assessment

As summarized in Figure 4, this initiative, through its multiple activities, has contributed to training students on a good set of soft and transferable skills. The color codes used in the cells provide a qualitative appraisal of the contribution of activities (rows) to the acquisition of skills (columns), whereas darker colors mean higher level of contribution.
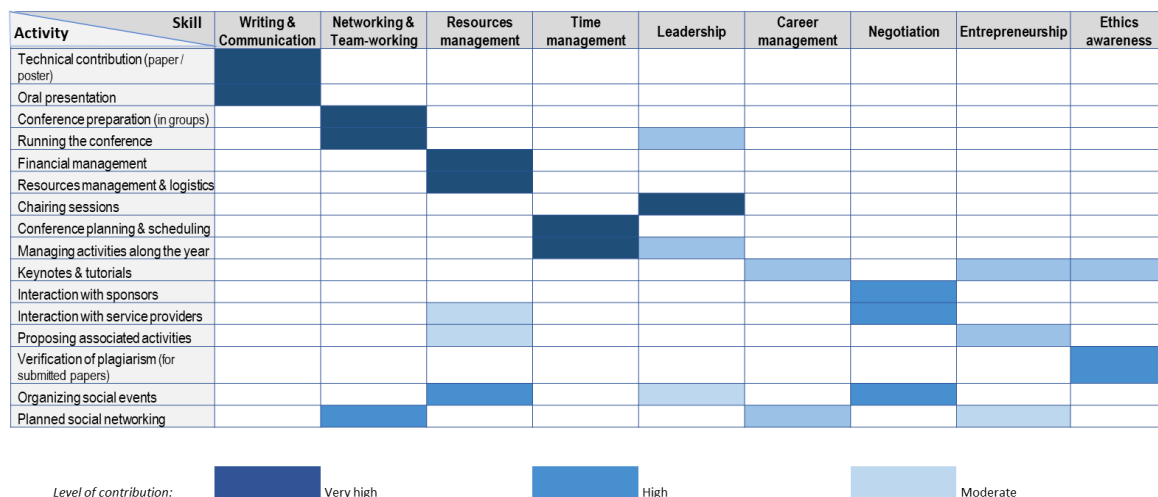
Activity ＼ Skill	Writing & Communication	Networking & Team-working	Resources management	Time management	Leadership	Career management	Negotiation	Entrepreneurship	Ethics awareness
Technical contribution (paper / poster)	Very high								
Oral presentation	Very high								
Conference preparation (in groups)		Very high							
Running the conference					Moderate				
Financial management			Very high						
Resources management & logistics			Very high						
Chairing sessions					Very high				
Conference planning & scheduling				Very high					
Managing activities along the year				Very high					
Keynotes & tutorials						Moderate		Moderate	
Interaction with sponsors							High		
Interaction with service providers			Moderate				High		
Proposing associated activities								Moderate	
Verification of plagiarism (for submitted papers)									High
Organizing social events			High		Moderate		High		
Planned social networking		High							

Level of contribution: ■ Very high　　　■ High　　　■ Moderate

Figure 4. Main covered skills.

This qualitative assessment is mainly based on professors' opinions, although the picture seems to be consistent with the assessment made by students in their reports. Other skills, such as problem solving/conflict resolution, listening, and planning, are also partially addressed, but in a variable degree depending on the group in which the student is involved.

The overall perception of value by the involved PhD students, reflected in their final assessment and reflection reports, is highly positive, as shown in Figure 5. This feedback was provided in free text, under specific entries in the report.
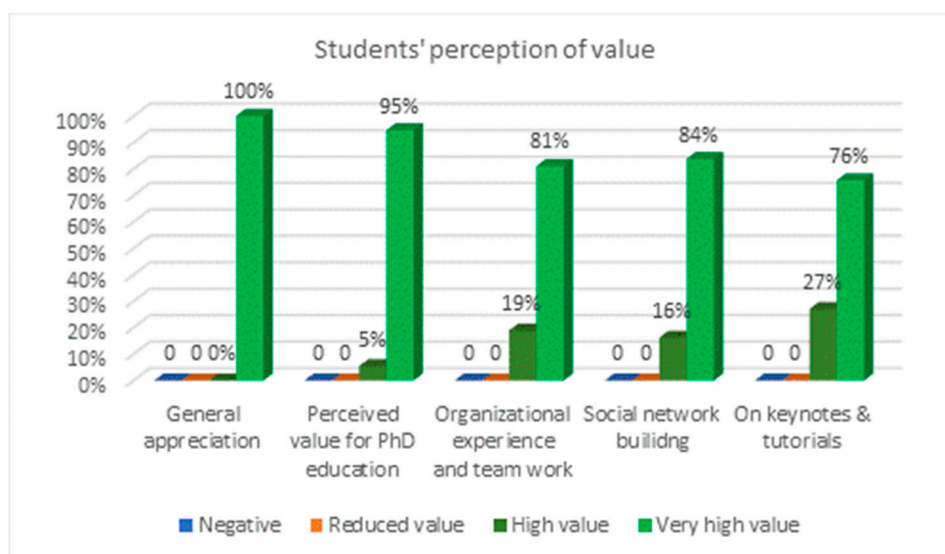

Figure 5. Students' feedback.

In addition to soft skill acquisition, students can also benefit from having papers published in prestigious proceedings and indexed in relevant databases.

Although there are no "good and effective systems and process for assessing soft skill" [19,20] the following subsections provide a more detailed analysis, focusing on specific aspects along the various stages of the conference organization.

4.2. Soft Skills and the Conference Stages

4.2.1. Preparatory Phase

This is the most important phase in the training process, spanning along 9–10 months. A major challenge for the professors that guide the students during this period is to avoid the effect of "repetition". As professors go year after the year through the same process, it is easier to overlook some of the more "mechanical steps", while in each edition, there is a new group of students that start from scratch and need to learn all the basics. Nevertheless, students' feedback along the years has been globally appreciative of the importance of being guided by professors with experience in organizing international events.

One aspect that most students emphasize in their reports is the need for enhanced communication between the working groups. As expressed by one student, "performing tasks in a timely manner and with good synchronization was one of the main challenges we faced". In addition to having some joint meetings, one trial was the edition of a periodic internal newsletter to keep all participants aware of the status of each task. However, the extra work required to keep it was excessive. A second attempt involved the adoption of a collaboration platform, but the necessary learning curve to effectively use it became also an obstacle. As such, the most effective mechanism so far was the increase of joint meetings complemented by extra coordination meetings of the involved professors.

Another student (2016 edition) stated: "Organizing a conference is not an easy job . . . it requires a lot of effort to perform such tasks that cannot be done by a single person or group. Besides intra-group interactions it also involves handling interactions with external companies, entities, and people that come from different areas, background, and cultures. Only the ones that once in life have organised a conference can understand the difficulty of making things simple and shiny for the participants". This testimony is a good example of understanding the benefits and what is involved in this process.

An example of faced difficulties can be illustrated by the following testimony (student from the 2016 edition): "I had some situations in which I (opted to) execute activities myself instead of delegating on other colleagues because I needed them done as soon as possible. All of us have many things to do, but sometimes people use it to justify their absence. In fact, collaborative work is not easy when some people consider their activities the most important. (In these occasions) The characteristic of leadership appears in some people, and I saw this behavior appearing several times in some people, delegating tasks to do, solving problems, contacting people and companies, and so on".

4.2.2. Running the Event

Since the established objective is that students can run the full event, professors only play a minor role at this stage in the background (a kind of safety net). It is during this phase that most synchronization among the various groups is needed in order to ensure a smooth running of the event. Students oversee all secretarial support, logistics, social events, assistance to attendees and invited speakers, and also chair the technical sessions. Furthermore, each student is also required to make either a paper presentation (if the submission is accepted by the international program committee) or a poster on the PhD research topic. For most of them, it is the first time they make a presentation in an international forum and the first time they chair a session. Nevertheless, the challenge was perfectly accomplished in all editions of DoCEIS and collected feedback, both from the students involved in the organization, and especially from the external attendees (through questionnaires), shows a high degree of satisfaction (results of a survey for the last 3 editions are shown in Figure 6).
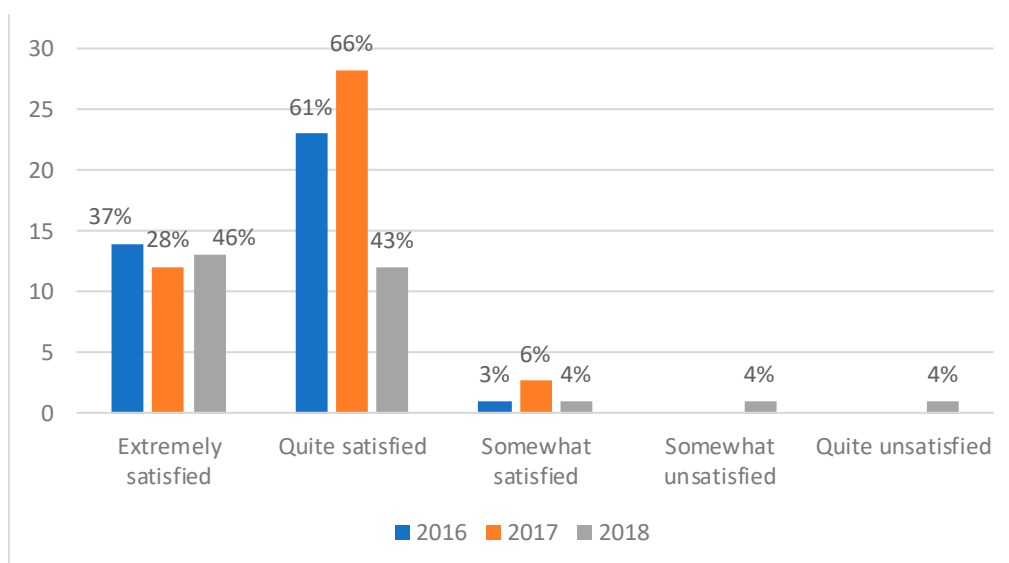
Figure 6. Attendees' satisfaction with the conference.

This confirms the effectiveness of skills acquisition through this approach. Particularly regarding session chairing, most students highlight both the challenges they faced and their importance in making them more self-confident and agile under stress. As some expressed, "an experience that . . . I will cherish for the rest of my life". "Chairing a session was the first time for me and it happened twice during DoCEIS conference. That was a great experience and it is my opinion that every PhD student should pass through this process during their PhDs". "Chairing a session was an absolute new experience for me, and one that I enjoyed greatly. I had to lead the session, manage the presentations, foment discussion from the audience, and (as it was the case) ask some questions in case the audience was not making many. Given the fact that the session's domain of research was not in my field of expertise, I prepared sets of questions for each of the three papers beforehand." (PhD students from the 2016 edition).

One challenge is the uneven distribution of workload among groups along the various phases of conference preparation. For instance, while the group in charge of the technical program has the main effort in the early phases, the organizational logistics group gets its main duties during the conference days, which also requires practicing some negotiation among groups for intergroup help. As students are aware of this reality since the beginning, no major problems were faced. Additionally, many of them identified intergroup help at different stages of the process as a success factor. In some cases, as a result of intergroup negotiation, some tasks are even dynamically reallocated. This may happen due an unexpected difficulty faced by one group, but also considering skills eventually possessed by some students in another group.

4.2.3. Introduction of Further Training

The inclusion of various items of a "summer school" type in the conference program proved successful for complementing students' training on soft and transferable skills. Although some students show some surprise a priori in seeing such topics in a technical conference, those sessions are typically well attended, and the feedback a posteriori, through questionnaires, is very positive. This can be illustrated by the following testimonies:

"The session focused on a topic of great importance and more and more current in any line of business, namely in engineering: ethics. The subject had already been previously addressed in one of the curricular units of the doctoral plan . . . the invited speaker exposed the topic in a different way, avoiding the presentation of the classic codes of conduct, and opting for a presentation based on images and selected parts of books. It was very clear and exciting in her presentation, taking an

unprecedented approach for me, which it was pleasing to everyone present at the session" (student from the 2011 edition).

"On the second day I attended the presentation on 'The Challenges of Communicating Science to the Public'. It was a very interesting presentation with a completely different view on technology and science, from the perspective of a journalist and the means to communicate our PhDs work and research." (student from the 2016 edition).

4.3. Unifying Theme and Interdisciplinary Spirit

The selection of the main theme for each edition (examples in Table 2) is crucial for the success of the conference. The acquired experience shows that this is a rather difficult task for students who, at this stage of their research careers, are too focused on their narrow topic. Therefore, the involved professors are usually required to play a major role in this task.

In order to guarantee some "glue" among all papers included in the proceedings, all authors are required to include a section where they explicitly relate their work to the main theme of the conference. Although this is a formal requirement, the success is moderate. Not all students are able to make a consistent link, and in some cases, the inclusion of such a section looks "artificial".

In terms of cultivating a multidisciplinary dialogue spirit, it shall be noted that most PhD students, often influenced by their supervisors, tend to prefer attending more specialized conferences, focused on their specific topic. Therefore, it is necessary that professors involved in this experience insist on all occasions, including conference opening and closing sessions, calling the attention of students to the importance of multidisciplinarity and interdisciplinarity in current research challenges [21]. All attendees are thus strongly encouraged to exercise dialogue with colleagues from other areas of expertise, to ask questions and try to make bridges between disciplines, especially taking advantage of a friendly environment where most attendees are PhD students. An example of positive feedback is expressed in the following testimony (student of the 2019 edition): "Although there were very few works related to my research area, the conference was very useful to promote my interest in other subjects and motivated me to continue looking for different fields of knowledge that could result in some kind of interaction with my research work". In fact, a reasonable level of dialogue has been observed in most sessions, but it is unclear to what extent all students became aware of the relevance of cultivating such spirit. Nonetheless, since all students are asked to synthetize, in their reports, the main novel ideas discussed at the conference, we could observe in all editions that most of them (>90%) were able to summarize ideas originating from different knowledge areas, which gives an indirect indication of success in this objective. Furthermore, an analysis of the contacts made by students during the conference, as reported by them, shows the following distribution: 30.2%—contacts with colleagues from the same knowledge area, 38.1%—contacts with colleagues from a "neighboring" area, and 31.7%—contacts with colleagues from totally different areas. None of the students limited their contacts to colleagues of the same area. These numbers show that the message was passed.

4.4. Dialogue Sessions

These sessions are for presentation of posters and aim at an active discussion between the poster presenters and the attendees. The goal is to use this mechanism for students in the early stage of their program to improve their communication skills and collect feedback on their research questions and hypotheses. For each poster, a 5-min presentation and 10-min discussion are typically allocated. The success of the sessions very much depends on the capability of the session chairs to encourage dialogue. For this purpose, such chairs need to be carefully selected, namely among more experienced PhD students, to whom specific guidance is given. Experience also shows that these sessions can benefit from the presence of professors that encourage discussion and provide advice.

All students that have chosen this modality to present their initial research ideas reported such sessions as very useful not only to get technical feedback and suggestions, but also to exercise their presentation and discussion skills on a multidisciplinary audience. Students involved in chairing these sessions also acknowledged that such a role is more demanding than chairing a normal paper presentation session, namely in terms of moderating the discussion. However, all acknowledged its importance for improving leadership and communication skills.

4.5. "Social Networking" Approach

During the initial lectures of the doctoral program courses, students are made aware of the importance for their careers of building a professional social network and how they can use conferences for that purpose. Close to the conference days, they are again reminded of the same objective and advised to check the participant list and their accepted papers in order to plan some contacts. As part of the conference program, a tutorial or seminar on building and using social networks is usually given by an invited expert.

During the conference, students are required to make a minimum of 5 contacts with attendees from other countries and to assess those interactions in their final reports. Furthermore, they are also asked to develop, for at least one case, a plan for further collaboration. The results of these requirements have been quite positive to break the shyness of some students. In general, all of them succeeded in making a good number of contacts and discussing possible relationships between their research topics. All students gave high relevance to this aspect in their reports (also because the report template includes a specific entry for this topic). Examples of testimonies:

"The DoCEIS conference was also a magnificent opportunity to meet new people and expand my social and professional network with participants from other institutes and countries. This interaction can lead to further collaborations for articles or even project proposals" (testimony from a student of the 2019 edition).

" . . . during the conference, I had the opportunity to increase my network of contacts" (testimony from another student of the 2019 edition).

Most of the reported interactions (>80%) involved colleagues of different nationalities. Regarding the goal of establishing plans for future collaboration, reported examples include plans for visits, writing joint papers, or even preparing joint project proposals. Nevertheless, about 30% of the students fail in this objective.

4.6. Impact

One indirect way of assessing the level of acquired skills is to check the impact of the conference proceedings. Table 4 provides an overview of the number of paper downloads and citations (data from Springer BookMetrix).

Table 4. Downloads and citations (as of 28 August 2020).

Edition	Chapter Downloads	Citations
DoCEIS 2010	134 k	140
DoCEIS 2011	137 k	228
DoCEIS 2012	100 k	122
DoCEIS 2013	239 k	167
DoCEIS 2014	113 k	128
DoCEIS 2015	84 k	100
DoCEIS 2016	62 k	94
DoCEIS 2017	45 k	35
DoCEIS 2018	14 k	34
DoCEIS 2019	9.8 k	33

Naturally, the proceedings of more recent editions are online for a shorter period and thus show smaller numbers. The selection of the main theme might also influence these numbers, as can be the case for 2013 with above 239,000 chapter downloads, when the selected theme was the Internet of Things.

According to BookMetrix, these numbers are substantially above the corresponding indicators for other proceedings in the same scientific area (top 25%, according to numbers of 2019). This certainly depends on the quality of the submissions and careful selection made by the Program Committee, but it also shows that the involved PhD students acquired the necessary skills to organize a professional international event. This is reflected in the acquired capability to plan and monitor the quality process, including selection of qualified reviewers, and following the standard procedures required by technical sponsors and publisher (resources and time management, ethics).

5. Conclusions

There is an increasing awareness of the relevance of acquisition of soft and transferable skills by Engineering PhD students. Such skills will empower future doctors for the multiple roles and responsibilities they will have along their professional life.

The organization of training activities on soft and transferable skills around an ambitious project of running a high-level international doctoral conference has proven to be an effective approach. Although PhD students at this stage of their careers are more focused on their specific research topics, the 10-year experience of including such training elements through a formal Doctoral Conference course, following a collaborative PBL approach, has received very positive feedback from all involved students. Our findings are also consistent with the statement in [19] that "soft skills are best learned with a small amount of highly focused and relevant formal input, a large amount of real-world experience, ... and timely, relevant and constructive feedback ... "

A testimony from a PhD student (2016 edition) represents well not only positive feedback but also a good understanding of the importance of such skills for a PhD student: "The participation in DoCEIS, not only as organizer but also as presenter, contributed to improve and to stimulate my soft skills. These skills, imperative for a successful career, were enhanced and, consequently, the main goals and the individual objectives of this course were achieved". Another relevant example representing a good synthesis: "Organizing a conference is seen as a burden at the beginning, but it quickly transcends into novelty and usefulness for the organizers".

The first edition of this course was a risky experience, which faced the skepticism of many professors in the department, but the achieved results proved to be a great success. One important success factor is the fact that these activities are organized as a compulsory course of the PhD program, since most students only perceive the benefits a posteriori. Setting high scientific goals from the beginning regarding the aimed quality of the conference also created additional motivation. If it was an optional and less ambitious activity, it would probably not have reached the same level of success. Another relevant factor is having the working groups guided by professors with good experience in organizing international conferences and extensive background knowledge on collaborative networks.

Although our findings are based on a single case, the experiment spanned along 10 editions, in the period of 2010–2019, involving 117 students in Electrical and Computer Engineering, which makes it a sizeable case. Collected feedback from multiple sources, including questionnaires, students' reports, and proceedings' impact indicators, confirms the effectiveness of the proposed model for soft and transferable skills acquisition.

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