

PhD training program activities from a global perspective. A comparison between two European Universities

M. Victoria Muerza-Marín

Aragon Institute of Engineering Research, I3A, University of Zaragoza, Spain

Abstract

The Bologna Process (BP) intends to create an European Higher Education area through the compatibility of degrees in the signatory countries. As a consequence, Universities have adapted its studies programmes at all academic levels. Few research has been made on the transversal training programmes required during the completion of a doctoral dissertation at a global level. This paper tries to cover the existing gap, and presents a comparison of the necessary requisites set in two Universities of two European countries: Spain and Germany. In addition, it analyses the duration and types of these doctorate programmes. The results show that differences between the analysed Universities are related to the contents of the programmes, control of activities and types of doctorate attending to the research approach, and the supervision system. The similarities are related to the duration of the doctoral programmes.

Keywords: PhD, doctorate programme, higher education, globalization.

Suggested citation:

Muerza-Marín, M.V. (2018). PhD training program activities from a global perspective. A comparison between two European Universities. In REDINE (Ed.), *Innovative strategies for Higher Education in Spain*. (pp. 123-130). Eindhoven, NL: Adaya Press.

Introduction

Continuous or permanent education is a complement of education that requires a learning, training or restructuring experience intended for updating the competences and generate a change of behavior in the participants (González, 2005). In this regard, postgraduate studies and more specifically, doctorate studies contribute significantly to the careers of individual degree-seekers, the health of academic disciplines, the performance and reputation of Higher Education Institutions and the economic, social, political, cultural and social well being of society at large (Boyle et al., 2015).

The title of Doctor comes from the Latin word of the same name and meaning, derived from the verb “docere”, i.e. to teach. The post-nominal letters “Ph.D.”, “PhD” or “D.Phil” are used to name it; the academic level varies depending on the country, institution and historical moment.

The nature of the PhD and doctoral education is undergoing through profound changes at present, due to several factors, e.g. different forms of study (professional and practice-based doctorates), new forms of thesis (thesis by publication, creative work plus exegesis), and new kinds of candidates from diverse educational backgrounds (Guerin et al., 2015), where globalization plays an important role as a driver of the communication and dissemination of knowledge.

Much of the literature effort has focused on identifying the competencies developed during the research period (Mowbray & Halse, 2010; Durette et al., 2014) or the factors that determine PhDs' careers (Subramaniam, 2003), PhD careers in firms (Thune, 2009; Herrera & Nieto, 2016) or motivation linked to PhD studies (Litalien et al., 2015). However, few research has been made on the transversal training programmes required during the completion of a doctoral dissertation at a global level. This research tries to cover the existing gap, and presents a comparison of the necessary requisites set in two Universities of two European countries: Spain and Germany. In addition, it analyses the duration and types of these doctorate programmes. The objective is to compare the required competences and capabilities to perform a research project that allows the student to obtain a doctorate degree.

The doctorate programme in the European higher education area

European Higher Education (EHE) policies, perceived for centuries as matters of national sovereignty, have significantly change since the BP (Capano & Piattoni, 2011). The BP is a European intergovernmental higher education project. Its aim is to form the EHE area through the compatibility of degrees in the signatory countries. In addition, the BP is an essential consideration in approaching the definition of Europe; it expands European borders and promotes the idea of a common European identity (Kushnir, 2016). This process

intends to enhance the attractiveness and competitiveness of the EHE by improving the graduates' competences to face the labour world.

The doctorate programme in the EHE area follows a structure in two levels (see Figure 1):

- *Level 1: Training period:* through the achievement of a Master degree or its equivalent, a minimum of 60 credits of the European Credit Transfer and Accumulation System (ECTS) or by holding a first degree of a minimum of 300 credits. The completion of this level is necessary as a previous step to be admitted in a doctorate programme.
- *Level 2: Research period:* it includes transversal training activities, the original research performed, the writing of the dissertation and its defense previous getting the doctorate qualification.

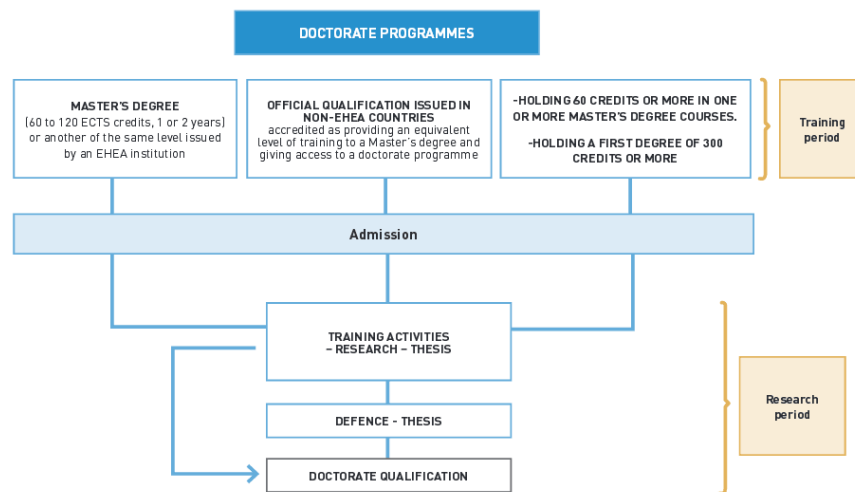


Figure 1. Structure of the doctorate programme in the EHE area. Source: Unizar (2010)

Method

This research compares two doctorate programmes after the admission period (see Figure 1) at an international level, according to the following characteristics:

- Research period contents.
- Types of doctorate.
- Duration of the doctorate programme.

The objective is to compare the required competences and capabilities to perform a research project that allows the student to obtain a doctorate degree. Two Universities

have been selected for this study: the University of Zaragoza (Spain), and the Technische Universität Bergakademie Freiberg (Germany). The selection is based on three criteria: (i) location in northern and southern Europe; (ii) similar size (number of doctorate students); and (iii) ranking of the University in both countries. The analysis focuses on the mechanical engineering doctorate programme.

Analysis of the PhD programme in Spain and Germany

PhD studies in Spain are regulated by the *Royal Decree 99/2011, 28 January*. The objective is that doctors play an essential role in those institutions involved in innovation and research, in order to lead the transfer of knowledge to the society. Furthermore, the regulation identifies a serie of competences that graduates will adquire through the completion of a doctorate programme (e.g. ability to design and implement a research process; development of an original research; ability to perform a critical analysis and evaluation and synthesis of new and complex ideas; communication capacity; and work as a team or autonomously in an international or multidisciplinary context).

In Germany, PhD studies are regulated by the *Universities Act* which is specific of the Federal state. This paper has considered the Saxon Universities Act of 10th December 10 2008 (TUBF, 2011), according to the University selected.

PhD in Mechanical Engineering. University of Zaragoza

This section focuses on the analysis of the doctorate programme in Mechanical Engineering of the University of Zaragoza (Unizar, 2016). An Academic Committee (AC) composed of five department professors is responsible for controlling and evaluating its compliance. In some cases, the AC may 'validate' training activities, for example when the candidate can demonstrate the acquisition of the corresponding skills through self-learning. The main characteristics of the programme include:

- *Research period contents*: Table 1 shows the structure and dedication in hours of the different activities to be performed.
- *Types of doctorate*: In addition to the University Program, Spain offers the possibility to carry out an "Industrial Doctorate". The candidate must comply with the following requirements: (i) have a labor or commercial contract with a company from the private or public sector; (ii) participate in an industrial research or experimental development project developed in the company; (iii) the project has to be directly related to the thesis carried out by the candidate.
- *Duration*: the doctorate programme will last a maximum of three years, full time, starting from the admission of the candidate to the program, and finishing with the defence of the doctoral thesis. However, with the prior authorization of the AC, part-time doctoral studies may be conducted, with a maximum duration of five years. Exceptions may be applied and duration may be extended from one to two years.

Table 1. Training Activities Requirements Mechanical Engineering doctorate program

	Activity (A)	Control
A1	Presentation of two 30-minute public seminars, one in the second year of the studies and another in the third, on the subjects of the doctoral research.	10 hours
A2	Assistance to seminars, workshops or talks about aspects that are state of the art in any of the program lines.	At least one per semester
A3	Courses or workshops on computer tools essential for research in Mechanical Engineering.	At least 15 hours
A4	Courses or workshops to promote the acquisition of transversal skills (e.g. Oral and written communication of scientific knowledge; Technical-scientific English; Database management; Researcher ethics; Preparation of scientific research proposals).	15 hours
A5	Preparation and presentation of papers in congresses and conferences.	10 hours (2 presentations)
A6	Research stays in other research groups, or in companies.	Min. 180 hours (1 month)
A7	Publications in international journals and/ or patents.	At least two

Source: Adapted from Unizar (2016)

PhD in Mechanical Engineering. Technische Universität Bergakademie Freiberg

This section focuses on the analysis of the doctorate programme in Mechanical Engineering of the Technische Universität Bergakademie Freiberg- TUBF (TUBF, 2016). The completion of a structured doctoral training programme is evaluated by a Doctorate Board (DB). The DB consists of a Chair, two reviewers, and at least two further full-time or retired University lecturers from the TU Bergakademie Freiberg. In addition, postdoctoral scientists are members entitled to vote. At most, half of the DB members eligible to vote may belong to the same institute. The DB is also responsible for examining the candidate's public defence.

The doctoral training programme is structured around two elements (TUBF, 2016):

- A study programme for the acquisition of subject-specific competences in doctoral studies. This programme must be accepted by the supervisor and the DB before the beginning of the studies.
- The acquisition of at least 15 Credit Points (CP). Of these, a minimum of 4 CP and a maximum of 8 CP, must come from subject-specific courses that are graded. Up to 6 CP can be acquired through teaching activity. The remaining credits can be obtained by means of additional interdisciplinary qualifications.

The main characteristics of the programme include:

- *Research period contents*: Table 2 shows the structure and dedication of the activities to be performed.
- *Types of doctorate*: In Germany, there are two common ways to get a PhD depending on the subject, the research proposal and the type of University (DAAD, 2016). The first is through individual doctoral studies. Here, candidates must find a University professor to supervise their work. Depending on the subject, the dissertation can be written independently or in collaboration with other researchers. Furthermore, doctoral candidates decide where they would like to conduct research (i.e. University, non-university research Organisation, industrial sector). The second way to get a PhD is through structured PhD programmes. In this type of programmes, a team of supervisors is responsible for advising doctoral candidates. The programmes offer a curriculum of accompanying courses, usually with an interdisciplinary focus. The main objective of this type of programmes is to promote the acquisition of “soft skills” and additional qualifications.
- *Duration*: An individual doctorate study usually lasts from three to five years. It depends on one’s personal schedule, or the length of one’s research contract. Similarly, the duration of a structured PhD programme lasts from three to four years.

Table 2. TUBF Program

		Activity (A)	Control
A1	Interdisciplinary seminars and seminars relevant to the subject	A1.1. Modules	Number of CP according to the regulations in the module manual of the relevant degree programme.
		A1.2. Courses	1 CP is equivalent to a workload of 30 hours. At least 4 CP must come from subject-specific courses that are graded. Requirement and recognition of qualifications from Bachelor’s, Master’s or Diplom degree courses.
A2	Soft skills and management	A2.1. Courses	1 CP is equivalent to a workload of 30 hours.
A3	Teaching	A3.1. Teaching	Up to 6 CP own through teaching activity. 1 hr/wk per semester (1SWS) teaching load is equivalent to 1 CP.
A4	Additional academic achievement	A4.1. Presentations at conferences	1 CP per presentation (max. 4 CP may be credited).
		A4.2. Publications	2 CP per publication, if leading author; up to 6 CP may be credited for accepted publications in peer-reviewed journals.
		A4.3. Supervision of students’ dissertation	Diplom-, Bachelor’s or Master’s thesis (1 CP per dissertation; up to 4 CP may be credited).

Source: Adapted from TUBF (2016)

Results

The analysis performed shows differences and similarities between the two Universities compared. The similarities are related to the duration of the doctoral programmes (from 3 to 5 years with special considerations). Differences are related to the contents of the programmes and control performed. One interesting finding is the inclusion of research stays in the doctorate programme of the University of Zaragoza. These stays must be performed in other research centers (including Universities) or companies, as a developer of external relations and a driver of the acquisition of competencies. Although the TUBF does not currently consider this type of activity as a requirement to complete the doctorate training programme, it includes teaching activities and supervision of students' dissertation (Diplom-, Bachelor's or Master's thesis). This result leads us to consider that the TUBF doctorate programme is more focused on a doctorate career towards academia. In addition, there are also differences regarding the types of doctorate in both Universities. The University of Zaragoza recognizes the figure of the "Industrial Doctorate" and the traditional doctorate by means of the completion of a University programme. The TUBF distinguishes between "Individual doctoral studies", where a professor is responsible for supervising the candidate and "Structured PhD programmes", where a team of supervisors is responsible for advising the doctoral candidate.

Conclusions

The Bologna Process intends to create an European Higher Education area through the compatibility of degrees in the signatory countries. As a consequence, Universities have adapted its studies programmes at all academic levels. The doctorate programme has undergone a profound remodeling, and transversal training programmes play an important role. This paper has analysed two EHE Mechanical Engineering doctorate programmes, one in Spain and other in Germany. The results show that differences between the analysed Universities are related to the contents of the programmes, control of activities and types of doctorate attending to the research approach, and the supervision system. The similarities are related to the duration of the doctorate programmes. It can be concluded that the BP has standardised the higher education programmes, trying to equalize the quality, novelty and scientific depth of a doctoral thesis.

Future research include the analysis of more number of Universities, in order to see the differences within the countries.

References

Boyle, M., Foote, K. E., & Gilmartin, M. (2015). Rethinking the PhD in geography: overview and introduction. *GeoJournal*, 80(2), 159-168.

- Capano, G., & Piattoni, S. (2011). From Bologna to Lisbon: The Political Uses of the Lisbon 'script' in European Higher Education Policy. *Journal of European Public Policy*, 18(4), 584–606.
- DAAD (2016). German Academic Exchange Service, <https://goo.gl/3IWhw4>, accessed January 30, 2016.
- Durette, B., Fournier, M., & Lafon, M. (2014). The core competencies of PhDs. *Studies in Higher Education*, 41(8), 1355-1370.
- González, S. (2005). Una perspectiva global del postgrado, su desarrollo en la Universidad del Bío-Bío y su vinculación con la productividad Científica. *Theoria*, 14(1), 5-6.
- Guerin, C., Jayatilaka, A., & Ranasinghe, D. (2015). Why start a higher degree by research? An exploratory factor analysis of motivations to undertake doctoral studies. *Higher Education Research and Development*, 34(1), 89-104.
- Herrera, L., & Nieto, M. (2016). PhD careers in Spanish industry: Job determinants in manufacturing versus non-manufacturing firms. *Technological Forecasting & Social Change*, 113(Part B), 341–351.
- Kushnir, I. (2016). The role of the Bologna Process in defining Europe. *European Educational Research Journal*, 15(6), 664–675.
- Litalien, D., Guay, F., & Morin, A.J.S. (2015). Motivation for PhD studies: Scale development and validation. *Learning and Individual Differences*, 41, 1-13.
- Mowbray, S., & Halse, C. (2010). The Purpose of the PhD: Theorising the Skills Acquired by Students. *Higher Education Research & Development*, 29(6), 653-64.
- Real Decreto 99/2011, de 28 de enero, por el que se regulan las enseñanzas oficiales de doctorado. BOE. núm. 35, de 10 de febrero de 2011.
- Subramaniam, N. (2003). Factors affecting the career progress of academic accountants in Australia: cross-institutional and gender perspectives. *Higher Education*, 46(4), 507-542.
- Thune, T. (2009). Doctoral students on the university–industry interface: a review of the literature. *Higher Education*, 58(5), 637-651.
- TUBF (2011). Regulations of the Faculties for the Award of Doctorates at the Technische Universität Bergakademie Freiberg, <https://goo.gl/XmeQfY>, accessed January 30, 2017.
- TUBF (2016). *Guide to doctoral studies*. Centre of Advanced Study and Research, <https://goo.gl/xgBsJP>, accessed January 30, 2017.
- Unizar (2010). Postgraduate Programmes Universidad de Zaragoza, <https://goo.gl/05KhHr>, accessed January 15, 2017.
- Unizar (2016). Doctorado en Ingeniería Mecánica, <http://doctoradoim.unizar.es>, accessed January 21, 2017.

Victoria Muerza is a researcher in the Aragon Institute of Engineering Research (i3a) of the University of Zaragoza and the Industrial Technologies Division. She holds a BSc in Electronics Engineering, a MSc in Industrial Engineering, and a PhD in Industrial Engineering all of them from the University of Zaragoza. She has been certified as a Risk Management Expert by the National Distance Education University (UNED). Her research interests include logistics, decision-making optimization, multicriteria decision making, the analysis and development of diversification strategies, the analysis of the technological capacity of regions and firms, the strategic management of technology, and technology evaluation. Orcid: 0000-0002-2405-4375.
