FLANDERS' TRAINING NETWORK FOR METHODOLOGY AND STATISTICS (FLAMES)

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FLAMES is an inter-university doctoral training network in which all five Flemish universities collaborate. It provides a structural, accessible, broad and high-quality course offer for young researchers needing methodological and statistical insight and skills. Capitalizing on complementary expertise it builds synergies and turns competition into collaboration to optimize available training and leverage science. We develop modules for basic, complex and advanced data analysis, organize a yearly two-week summer school and workshops on demand. Our co-taught courses travel the country. We will share 6 years of experience with the new model for collaboration sponsored by government, carried by faculty and coordinators from various disciplines in the different universities. We hope to learn from similar international experiments to build a network that can reach further.

BACKGROUND

The Flanders Training Network for Methodology and Statistics (FLAMES) is a joint training initiative of the five Flemish universities (Free University of Brussels, Ghent University, Hasselt University, KU Leuven and University of Antwerp). The initiative was launched shortly after the introduction of formalized doctoral schools at Flanders universities. From 2008, all five universities have established such organizational frameworks to support doctoral training. The institutional structures are organized at a centralized level although they operate at different levels in different institutions. While some universities have one centralized doctoral school (University of Antwerp), others have three (Free University of Brussels, Hasselt University, KU Leuven) or five (Ghent University) doctoral schools organized around specific disciplines: (i) Doctoral School of Human Sciences; (ii) Doctoral School of Life Sciences and Medicine; (iii) Doctoral School of Natural Sciences and Engineering; or (i) Doctoral School of Arts, Humanities and Law; (ii) Doctoral School of Social and Behavioural Sciences; (iii) Doctoral School of Natural Sciences; (iv) Doctoral School of Life Sciences and Medicine; (v) Doctoral School of (Bioscience) Engineering).

Doctoral education became central to the mission of all universities. In line with European diversity of doctoral education models, Flanders takes strength from the diversity of its organization of doctoral training. All institutions maintain a common goal for doctoral education in line with the reforms at the European level (EUA, 2016). Higher Education reforms started with the Bologna Declaration of 1999 and focused on doctoral education with the Bologna process conference which was held in Salzburg in 2005 resulting in 'The Salzburg Principles' (EUA 2005). They outline ten principles of high quality for doctoral education in Europe, independent of national, legal or disciplinary particularities (Kovačević & Mihaljević, 2016). In 2010, the Salzburg II Recommendations were added to ensure structural changes on both program and organizational level but also to emphasize the autonomy of all institutions on how to establish doctoral education. European doctoral education is characterized by its diversity. In 2008 the European University Association's Council for Doctoral Education (EUA-CDE) was established to improve doctoral education in Europe and to continue the implementation of reforms in doctoral education building on the Salzburg Principles (EUA, 2005) and Recommendations (EUA, 2010). The engagement of EUA-CDE extends from university leaders to those involved in the delivery of doctoral training and supervision. Besides common European principles and recommendations it is important that structures are supported by institutional leadership that allocates adequate resources to ensure sustainable structures in terms of funding and staff.

A strong incentive to initiate the joint FLAMES training network was the Flanders governmental decision (VR/2011/25.11/doc 1165) to financially support doctoral training in Flanders. The budget was set to 4 million Euros a year to be spent following three basic rules on (i)

research support, (ii) career training, and (iii) internationalization of early stage researchers (ESR). Additional regulations stipulated that 25% of the budget (or 1 million Euro) should be spent on joint 'interuniversity' activities. A first working group was initiated by Ghent University (23/04/2012) where stakeholders in doctoral education from the various universities were invited. Soon after this first meeting, an official round table was organized by the Flemish Interuniversity Council (Vlaamse Interuniversitaire Raad - VLIR) (1/06/2012) who represents the Flemish universities and serves as a platform to facilitate cooperation between all five Flemish universities. VLIR also interacts with the Flemish government in all matters concerning higher education policy. After a few meetings hosted by the Flemish Interuniversity Council it was decided to hire three full time equivalent (3FTE) doctoral holders in statistics and/or methodology. They would work in team for the overarching project, but be employed (some of them part-time) by one of the universities. Several candidates were already connected to one of the universities and then employed by the FLAMES team as part time trainers. They form a dynamic team of experts in research methodology/statistics dedicated to the methodological training of ESR. They contribute to the development of training materials, provide training sessions at the different universities in Flanders, maintain a website designed to disseminate up to date information on available courses, participate in the organization of several training activities (colloquia, summer schools, …) and coordinate demand and supply.

Activities include: organizing colloquia and summer schools in methodology and statistics; interacting with young researchers and lecturers in various disciplines; developing new teaching modules; preparing course material for exchange; developing instructive case studies; preparing training materials; providing customized training sessions; turning course material into more broadly usable software solutions for research/teaching questions; hosting and maintaining the website.

FLAMES was officially launched on 31 May 2013 (Brussels) and the first summer school took place September 2013 (Leuven). The steering board formulated the mission statement as follows: FLAMES is an inter-university training network rooted in the five Flemish universities. This network aims to support young researchers in their pursuit of best-in-class training in methodology and statistics by providing an overarching, structural, large and high-quality course offer for doctoral students and young empirical researchers. Flemish universities provide world class science and teaching and stand for high quality experiences. The overall goal is to strengthen research across the universities in a spirit of collaboration.

In the following paragraph we will present the output of our training network.

FLAMES OUTPUT

FLAMES organizes training events and courses on statistics and methodology, which build on the complementary expertise of the coordinators at the five Flemish universities. Its activities consist of various interuniversity courses during the academic year, an annual two-week Summer School offering over fourteen modules, an Annual Meeting devoted to a special theme, the bi-annual issue of an award to an excellent person or organization in statistics or methodology, and support for the annual meeting of the Royal Belgian Statistical Society in the form of a PhD day. In addition, FLAMES runs a website and distributes a monthly Newsflash in order to promote its events.

The interuniversity (IU) courses are short courses of two or three days throughout the academic year which cater to a need among PhD students and post-doctoral researchers for practical skills in statistics or methodology. As a rule, they are taught by the team of coordinators with complementary backgrounds, but guest lecturers have occasionally been invited. Furthermore, the IU courses rotate over the five Flemish universities in an even fashion. Table 1 presents the overview of all the FLAMES IU courses since FLAMES' inception in 2013. It can be seen that the IU courses attracted a total number of 740 participants over the years and that the number of IU courses quadrupled during that time. That can be taken as a proof of the popularity of FLAMES' IU courses among PhD students and post-doctoral researchers, and we are still looking for topics with which to increase the number of IU courses.

Table 1. A growing number of FLAMES IU courses

IU Course Title	2013-14	2014-15	2015-16	2016-17	Total no. participants
Capita Selecta Survival Analysis	-	12	11	-	23
Categorical Data Analysis	-	-	20	47	67
Graphics in R	28	30	26	42	126
Missing Data	-	-	36	30	66
Method in Data Collection	-	36	37	47	120
Method in Research Design	-	32	43	52	127
Questionnaire Construction and Analysis	31	30	27	31	119
Survival Analysis in R	-	-	29	28	57
Tools for Multivariate Data Analysis	-	-	-	25	25
Total no. participants	59	150	229	302	740

Next to the IU courses, FLAMES organizes a Summer School which takes place each September at a different university. Since the four modules that formed our proof of concept at KU Leuven in 2013 the FLAMES Summer School has grown into a two-week program with fourteen modules covering both qualitative and quantitative methods, basic as well as more advanced techniques, and several modules consisting of both theoretical lectures and practical sessions in PC rooms. See the overview in Table 2.

Table 2. Overview of the FLAMES Summer School modules

Module title	2012-13 (KU Leuven)	2013-14 (UGent)	2014-15 (VUB)	2015-16 (UHasselt)	2016-17 (UAntwerp)	Total no. participants
Basic Regression Analysis	62	74	67	49	64	316
Research Design	77	41	49	71	62	300
Basic Statistical Principles	105	74	-	-	-	179
Basic Parametric Statistics	-	-	77	49	53	179
Multilevel Analysis	-	54	39	28	26	147
Basic Nonparametric Statistics	-	-	29	43	49	121
Introduction to NVIVO	-	22	36	37	24	119
Focus Groups	-	17	33	26	25	101
Research Management	-	20	32	28	-	80
Factor Analysis	-	-	37	21	25	83
Introduction to Practical Statistics	-	14	10	30	22	76
Advanced Computations in R	34	27	-	-	-	61
Advanced Linear Regression	-	53	-	-	-	53
Narrative Analysis	-	17	34	-	-	51
Qualitative Research Design	-	-	-	28	28	56
Time Series Analysis	-	-	-	18	22	40
GLMs	-	-	-	18	22	35
Multistage Models	-	-	33	-	-	33
Writing Packages in R	-	-	-	14	14	28
Data Mining	-	-	-	-	22	22
Total no. participants	278	413	476	460	458	2085

The concise format of the Summer School in two weeks is particularly suited to young researchers who are at the start of their project or who need to acquire statistical or methodological skills in a short amount of time. Furthermore, there are two social events, one in each week, which provide a unique opportunity to the participants for networking.

FLAMES also organizes an Annual Meeting around a specific topic of interest. The titles of the past Annual Meetings are *Scientific Integrity: Consciously (un)making mistakes* (VUBrussel, 2014), *Big in Data?* (UGent, 2015); *P values? The problem is not what you think* (UAntwerp, 2016), *Social Media: the good the bad or the ugly? The impact of social media on science, education, society and economy* (KU Leuven, 2017) and the next Annual meeting will be about *Implementing the EU General Data Protection Regulation* (UHasselt, 2018). Each Annual Meeting offers various lectures by both international and national experts.

Since 2013, every two years FLAMES presents an award to a person or institution for their contributions to the field of statistics or methodology. At the launch event of FLAMES, 31st of May in Brussels, Luc Bijnens was awarded with the first FLAMES award in recognition of outstanding ambassadorship of good use of methodology and statistics. The FLAMES award was presented by Danielle Gilliot, advisor of Minister of Innovation Ingrid Lieten. In 2015 the laureate was *the European Organization for Research and Treatment of Cancer* (EORTC) and the laureate in 2017 was the *Research Institute for Nature and Forest* (INBO). These awards were issued at the Summer School 2015 and the Annual Meeting 2017, respectively.

Finally, FLAMES supports a PhD Day at the annual meeting of the Royal Belgian Statistical Society. Such PhD Days have been organized in 2015 at UAntwerp, in 2016 at UNamur and in 2017 at KU Leuven. All these events require promotion and FLAMES has therefore also set up its own communication channels. More specifically, the FLAMES coordinators maintain a website (www.flames-statistics.eu) and they release a Newsflash every month.

FLAMES TRAINING PRINCIPLES

In this section we will discuss key principles of FLAMES training network and summer school. FLAMES offers a training program for a diverse group of early stage researchers (ESR). Doctoral candidates are -unlike graduate students- likely to pursue a unique training and they experience a different and more personalized research environment (Aitchison & Anthony, 2012). This personalized research environment becomes even more important for post-doctoral researchers. FLAMES is dealing with this diversity in different ways as explained in the following principles.

Embedded in doctoral training program: As was explained in the background, FLAMES' events are closely connected to the training program offered by the Doctoral Schools of the five Flemish universities. The Doctoral Schools were founded in 2013 with the explicit threefold aim to support research, enhance career skills and promote internationalization among ESR. FLAMES contributes to research support at an international level by providing practical training in methodological and statistical skills for all scientific disciplines. Therefore, FLAMES events are advertised in regular updates of the communication channels (viz. websites and newsletters) of the Doctoral Schools.

Qualitative versus quantitative track: In FLAMES we find it important to reach out to the whole community of ESR, so we organize training in both quantitative and qualitative methods as well as mixed methods research. For instance, some modules of the FLAMES Summer School are grouped into a qualitative and a quantitative track in order to streamline the registrations by offering the participants a concise program of related and complementary courses. The quantitative track consists of the modules *Introduction to Practical Statistics*, *Basic Parametric Statistics*, *Basic Nonparametric Statistics* and *Basic Regression Analysis*, and the qualitative track consists of *Introduction to NVivo*, *Research Design*, *Focus Groups* and *Qualitative Research Design* (see Table 2).

Basic courses and specialized courses: Another aim of FLAMES is to meet a full range of skills going from basic methods to advanced or specialized techniques. The basic courses include Summer School modules such as *Introduction to practical statistics*, *Introduction to NVivo* and *Research Design*. The advanced and specialized courses are *Time Series Analysis*, *Data Mining* and *Focus Groups*. The division between basic and specialized modules corresponds more or less to the

different schedules in the first week end the second week of the Summer School (although some basic modules such as *Basic Regression Analysis* are in fact taught in the second week while some specialized modules such as *Multilevel Analysis* are given in the first week).

Contributing to scientific integrity: Good statistical practice and data management is seen as central to research integrity in scientific practices these days. Most students never put statistics they learned into practice. Now they need a practice oriented training, ideally with hands-on experience related to their research design. This way, FLAMES contributes to avoid questionable research practices or misconduct.

Different software packages: Even though IU courses are sometimes interwoven with software codes on how to perform certain tasks, FLAMES regularly offers full hands-on courses to train students on the use of different software such as R, SPSS, SAS, NVIVO, Python, etc. Certain courses are offered with examples or practical sessions using different software to accommodate the needs for participants with different software orientations. This is the case, where upon applying to take part in the course, students express preference or familiarity with different software. All students registered in any of the five Flemish universities have access to the most commonly used statistical software.

Lectures and hands on training: Since the FLAMES courses are designed for PhD students with diverse backgrounds, most IU courses consist of:

- a theoretical component where fundamental concepts are introduced with examples
- a practical tutorial component which allows students to apply hands-on, concepts they have mastered
- a group work assignment where students are encouraged to work in groups. Sometimes students are encouraged to use data from their own research
- detailed feedback sessions on homework and project work.

Through the group projects, students are offered the opportunity to benefit from complementary expertise from other group members.

Interdisciplinary groups: Being an interuniversity network, FLAMES embraces PhD students from 5 different universities with diverse backgrounds during the summer school and IU courses it organizes. FLAMES courses are either basic, intermediate or advanced with the necessary prerequisites (software and theoretical knowledge) outlined. The courses are presented with the goal of training students how to think and apply the concepts to their own research. A good balance in level and teaching speed, is maintained during the delivery of the courses so that it stays appealing to all groups. The interdisciplinary and interuniversity structure also benefits and encourages some local initiatives which then come open to the entire network. Local initiatives seem instrumental for the feasibility of the project and the local support.

In the final section we will discuss the strengths, the weaknesses, the opportunities and the threats of the FLAMES project in order to improve the output and to maximize the support for future ESR.

SWOT ANALYSIS OF FLAMES

Strengths: FLAMES staff is supported on a yearly basis by government funds granted to each university. Without this support we could not develop nor carry the training initiatives in methodology and statistics that are currently open to young researchers at the 5 Flemish universities. The FLAMES team brings a relevant spectrum of interuniversity training through expertise available in the network, which is unique in Flanders. Tables above illustrate that the demand for this stays high. Our own quality management system promotes high level standards as all training initiatives are evaluated by the participants and discussed at steering board meetings. For the university authorities, each year policy plans are submitted, the implementation of the previous policy plan checked and prolonged funding requested.

Weaknesses: While we also invite post-doctoral researchers, FLAMES training targets primarily PhD researchers. The more experienced post-doctoral researchers, however, need more advanced and customized training and have a special interest in training initiatives involving collaboration with the industry.

For some short course topics, we rely on external lecturers. While it could be seen as a weakness that not all relevant aspects of the discipline are covered by the FLAMES team, this is of course

unavoidable. As the discipline is fast expanding with a scope that reaches out to a whole new realm of Big Data science, it may be important to invest in expertise covering access to new and large data streams. In the current budget, there is no room for inviting international PhD students to our FLAMES initiatives.

Opportunities: The external expertise brought in for training can also be seen as added value. Even though it comes with some financial cost, it will yield broader and more cost effective access for young researchers than when they must go abroad. FLAMES training is given in English to allow for inclusion of international ESRS at our local universities. This makes it in principle accessible to international exchange at the ESR level. Future development of specific post-doctoral level training could engage industrial stakeholders to facilitate transition into the job market. The new inter-university training concept lends itself to networking with other similar international initiatives and learn from this exchange.

Threats: There is a governmental decision to financially support doctoral training initiatives in Flanders. The amount of this financial support is however not known in advance and is fixed annually. The related uncertainty and late communication of the size of the annual FLAMES budget complicates long-term commitments towards staff. This uncertainty combined with a high demand on the job market for staff members with the statistical and methodological profile (Tishkovskaya & Lancaster, 2012) leads to a high turnover of talented FLAMES staff among the universities. This past few years, due to savings, the budget remains unchanged while the number of PhD researchers at our universities is increasing year by year. Alongside, the interest and the need to perform a profound statistical and methodological analysis is exponentially increasing (Data is the new gold!). As a result, the FLAMES budget per researcher is decreasing year by year and hardly allows to expand into the new realms of Big Data science.

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