FLAMES (FLANDERS TRAINING NETWORK FOR METHODOLOGY AND STATISTICS): A LONGITUDINAL ANALYSIS OF OUR DOCTORAL TRAINING INITIATIVE

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Within the 5 Flemish universities of Belgium, the need for statistical support of doctoral-level students has led to the introduction of FLAMES, an inter-university doctoral training network in which all Flemish universities of Belgium collaborate. FLAMES aims to support young researchers in need of qualitative and quantitative oriented insights by offering them methodological training at different levels. To evaluate the importance and popularity of FLAMES, a longitudinal analysis is performed where the FLAMES approach is discussed over a timeline of approximately 10 years (from the beginning of Flames until 2021). FLAMES' "measuring is knowing" principle is used to evaluate the content, applicability, and educational aspects of the current training offer and to periodically assess the efficiency of our program.

FLAMES FRAMEWORK AND MISSION

Flanders training network for Methodology and Statistics (FLAMES) is a joint training initiative of the five Flemish universities, i.e., Catholic University of Leuven (KU Leuven), University of Hasselt (UHasselt), Free University of Brussels (VUB), Ghent University (UGent), and University of Antwerp (UAntwerp), with the aim to support doctoral students and young empirical researchers in their pursuit of supreme training in methodology and statistics. High-quality and -intensity qualitative, quantitative, and data science courses are organized through the academic year, categorized in four main domains: (a) short training local initiatives (colloquia, seminars, workshops), organized within a specific university and mostly lasting one day; (b) inter-university (IU) courses, i.e., short courses of two or three days rotate over the five Flemish universities in an even fashion; (c) an annual two-week summer school offering over +/- 16 modules; and (d) an annual one-day meeting devoted to a special theme. These courses and seminars are built on the complementary expertise of the trainers (what we call the coordinators) at the five Flemish universities, but guest lecturers have occasionally been invited if specific expertise was needed. Additional to the development of new materials and teaching new courses, the FLAMES coordinators also work in a team to contribute to other tasks as well. Some activities include:

- organizing colloquia and summer schools in methodology, statistics, and data science;
- 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 questions; and
- hosting and maintaining the website.

POPULARITY OF FLAMES TO PARTICIPANTS

Since the official launch of FLAMES on 31 May 2013 in Brussels, a total of 13,346 students participated in FLAMES activities; see Table 1. The numbers do not just show a steady growth in the number of students enrolled in the early years of FLAMES. In the last three academic years (18/19–20/21), an exponential increase in the number of participants was observed. FLAMES is supported by all universities, with students from five institutions. In the following paragraphs, we discuss each of the activities in detail.

Table 1. Number of student contacts per type of FLAMES activity and per year

	Academic year									
	12–13	13–14	14–15	15–16	16–17	17–18	18–19	19–20	20–21	Total
IU courses	-	59	140	229	302	237	226	727	1671	3591
Local initiatives	246	525	549	367	473	499	615	989	1420	5683
Summer school	278	413	476	460	458	444	521	567	455	4072
Total	524	997	1165	1056	1233	1180	1362	2283	3546	13346

Flames Summer School

The first edition of the summer school took place September 2013 in Leuven. Starting with four modules that formed proof of concepts at KU Leuven in 2013, the FLAMES summer school has grown into a two-week program with approximately 16 modules of different durations and format devoted to both qualitative and quantitative methods, basic as well as more advanced techniques, and several modules consisting of both theoretical lectures and practical sessions in computer rooms. The FLAMES Summer School (FSS) has been realized at each of the universities (KULeuven 2013; UGent 2014; VUB 2015; UHasselt 2016; UAntwerp 2017). In 2018, the summer school was hosted for the second time by KU Leuven, starting the second round of rotation among the universities (KULeuven 2018; UGent 2019; VUB 2020; UHasselt 2021). Table 2 presents an overview of the number of participants for FLAMES summer school modules.

The summer school has the aim to reach a majority of the Flemish ESR (Early Stage Research) audience. To do so, a learning environment has been created addressing main topics in statistics and methodology. Modules are taught by a group of lecturers, including the FLAMES coordinators and external teachers. Each external teacher's invitation is based on the fact that they are an expert in the subject. FLAMES coordinators in particular cover the basic modules. Two extra features are offered for a "complete summer school experience." First, we offer full, hands-on courses on the use of statistical software (Python, R, etc.). Second, we organize a social program, mainly two social events (one in each week), which provide participants with a unique opportunity to network and interact with the FLAMES team.

Flames Inter-University Courses

In addition to the summer school, extra-curricular events are organized throughout the academic year, separated between inter-university (IU) courses and local initiatives. The former courses consist of:
● a theoretical component where fundamental concepts are introduced with examples;
● a practical tutorial component which allows hands-on applications of concepts students have mastered;
● a group work assignment where students are encouraged to work in groups, sometimes using data from their own research; and
● detailed feedback sessions on homework and project work.

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 SPSS, R, SAS, NVIVO, Python, etc. Certain courses are offered with examples or practical sessions using different software to accommodate the needs of participants with different software orientations. This occurs when, upon applying to take part in a 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.

Table 3 presents a detailed overview of the FLAMES IU courses since the beginning of FLAMES in 2013. It can be seen that the IU courses attracted a total number of 3,591 participants over the years and that the number of IU courses quadrupled during that time. That can be taken as proof of the popularity of FLAMES' IU courses among PhD students and post-doctoral researchers.

Table 2. Number of students enrolled per module and edition of the FLAMES Summer School

	'13	'14	'15	'16	'17	'18	'19	'20	'21	Total
Basic Regression Analysis	62	74	67	49	64	46	43	44	-	449
Research Design	77	41	49	71	62	54	34	37	22	447
Basic Statistical Principles	105	74	-	-	-	-	9	-	-	188
Basic Parametric Statistics	-	-	77	49	53	44	48	45	30	346
Multilevel Analysis	-	54	39	28	26	28	28	33	46	282
Data Analysis with Python	-	-	-	-	-	-	31	30	30	91
Basic Nonparametric Statistics	-	-	29	43	49	42	35	35	19	252
Introduction to NVIVO	-	22	36	37	24	25	23	25	24	216
Focus Groups	-	17	33	26	25	22	19	25	17	184
Web-apps with Shiny	-	-	-	-	-	-	9	16	19	44
Intro to Machine Learning	-	-	-	-	-	-	30	34	26	90
Research Management	-	20	32	28	-	-	-	-	-	80
Factor Analysis	-	-	37	21	25	24	18	21	17	163
Ethnograpical research	-	-	-	-	-	-	21	23	12	56
Github, GDPR and research management	-	-	-	-	-	-	4	-	-	4
Intro to Practical Statistics	-	14	10	30	22	12	-	33	13	134
Meta Analysis	-	-	-	-	-	-	14	-	-	14
Phenomenological Analysis	-	-	-	-	-	-	14	17	13	44
Advanced Computations in R	34	27	-	-	-	-	-	-	-	61
Essential tools in R	-	-	-	-	-	-	-	37	38	75
Advanced Linear Regression	-	53	-	-	-	-	-	-	-	53
Network Analysis	-	-	-	-	-	-	12	-	-	12
Narrative Analysis	-	17	34	-	19	19	12	21	18	140
Qualitative Research Design	-	-	-	28	28	22	25	8	22	133
Time Series Analysis	-	-	-	18	22	20	14	20	15	109
GLMs	-	-	-	18	22	34	38	36	33	181
Longitudinal and Incomplete Data	-	-	-	-	-	-	15	-	21	36
Survival analysis	-	-	-	-	-	-	-	13	-	13
Multistage Models	-	-	33	-	-	-	-	-	-	33
Writing Packages in R	-	-	-	14	14	7	-	-	-	35
Bayesian Data Analysis	-	-	-	-	-	25	25	14	20	84
Data Mining	-	-	-	-	22	20	-	-	-	42
Total	278	413	476	460	458	444	521	567	455	4072

FLAMES Local Initiatives

The local FLAMES initiatives include various activities, ranging from lectures of 1–2 hours, to multi-day courses and workshops on all kinds of statistical and/or methodological topics. The FLAMES staff is responsible for these activities, with possible assistance from guest lecturers. Between 2013 and 2021, 5,683 students and postdoctoral researchers participated in local FLAMES initiatives; see Table 1.

LEARNING FROM FLAMES ACTIVITIES: THE ''MEASURING IS KNOWING'' PRINCIPLE

At the end of every FLAMES event, an evaluation form is sent to participants, containing a series of questions and room for open comments. This is intended to determine the participants' level

of satisfaction with our events. The form structure and questions are based on the four levels of the Evaluation Process proposed by Kirkpatrick (1998): reaction, learning, behaviors, and results.

Table 3. Number of students enrolled per inter-university (IU) course and per year

	13-14	14-15	15-16	16-17	17-18	18-19	19-20	20-21	Total
Capita Selecta Survival Analysis	-	12	11	-	-	-	-	-	23
Categorical Data Analysis	-	-	20	47	30	25	19	-	141
Graphics in R	28	30	26	42	29	20	17	51	243
Missing Data	-	-	36	30	21	22	61	38	208
Method in Data Collection	-	36	37	47	24	39	19	48	250
Method in Research Design	-	32	43	52	40	46	29	63	305
Questionnaire Construction and Analysis	31	30	27	31	38	30	37	21	245
Survival Analysis in R	-	-	29	28	30	14	-	28	129
Tools for Multivariate Data Analysis	-	-	-	25	25	30	21	30	131
(Statistical) Data Science for the Business User	-	-	-	-	-	-	15	15	30
A Practical Introduction to Data Science	-	-	-	-	-	-	15	7	22
Essential tools for R	-	-	-	-	-	-	27	183	210
Importing & Tidying data in R	-	-	-	-	-	-	39	-	39
Introduction to Critical Discourse Analysis	-	-	-	-	-	-	20	42	62
Introduction to Python	-	-	-	-	-	-	44	18	62
Introduction to SAS	-	-	-	-	-	-	29	-	29
Qualitative Research	-	-	-	-	-	-	21	22	43
SPSS for beginners	-	-	-	-	-	-	14	61	75
An introduction to databases for young researchers	-	-	-	-	-	-	28	21	49
Data wrangling & tidying with tidyverse	-	-	-	-	-	-	25	86	111
Data wrangling in Python	-	-	-	-	-	-	20	54	74
Design and analysis of observational studies	-	-	-	-	-	-	38	43	81
Introduction to data analysis with Python	-	-	-	-	-	-	23	95	118
Introduction to JMP	-	-	-	-	-	-	15	29	44
Introduction to social network analysis (SNA)	-	-	-	-	-	-	11	51	62
Qualitative data analysis with NVivo	-	-	-	-	-	-	55	44	99
Spatial analysis using R	-	-	-	-	-	-	29	23	52
Statistical modeling using R	-	-	-	-	-	-	50	30	80
Strategies in qualitative data analysis from a Grounded Theory perspective	-	-	-	-	-	-	6	27	33
Exploring data analysis with R	-	-	-	-	-	-	-	23	23
Focus groups (for beginners)	-	-	-	-	-	-	-	17	17
Intervision for starting PhD students	-	-	-	-	-	-	-	10	10

Narrative Analysis	-	-	-	-	-	-	-	35	35
Photovoice	-	-	-	-	-	-	-	18	18
An introduction to writing qualitative research papers for publication in academic journals	-	-	-	-	-	-	-	72	72
Causality in qualitative research	-	-	-	-	-	-	-	23	23
Developing interview questions and basic interview skills	-	-	-	-	-	-	-	21	21
Essentials of qualitative research design	-	-	-	-	-	-	-	19	19
Focus Group Interviews for Advanced Users	-	-	-	-	-	-	-	25	25
Global classroom Arts-based Research	-	-	-	-	-	-	-	12	12
Introduction to Big Data Processing	-	-	-	-	-	-	-	25	25
Introduction to NVivo (basic)	-	-	-	-	-	-	-	30	30
Textmining in R	-	-	-	-	-	-	-	16	16
Literature Reviews with Nvivo	-	-	-	-	-	-	-	30	30
Qualitative Comparative Analysis	-	-	-	-	-	-	-	22	22
Quality assessment in qualitative research	-	-	-	-	-	-	-	25	25
Regression with Ordinal Variables	-	-	-	-	-	-	-	19	19
Searching text patterns using regular expressions	-	-	-	-	-	-	-	20	20
Statistical Principles of Clinical Trials	-	-	-	-	-	-	-	28	28
Thematic Analysis	-	-	-	-	-	-	-	20	20
Theoretical design and design of data collection in observational explanatory (causal) research	-	-	-	-	-	-	-	4	4
Ethnographic Research	-	-	-	-	-	-	-	27	27
Total	59	140	229	302	237	226	727	1671	3591

Example: Evaluation of the 2018 FLAMES Summer School

In the FSS evaluation form from 2018, three main sections were interrogated: (a) a section about the participants' summer school experience, (b) a section concerning the module(s) they followed, and (c) a section on future events. In what follows, we will discuss all three parts of the evaluation.

First, two questions about their summer school experience are asked:

- Will you recommend the Summer School to colleagues?
- Overall, on a scale of 1 to 10, (1=very poor, 10=outstanding), how do you evaluate the Summer School?

An average appreciation score of 7.87 (on a scale from 1 to 10, with 10 being the highest) was given, with 61% of participants indicating they would recommend the Summer School to colleagues.

The second part mainly focuses on specific module(s), and the quality of teaching and course materials are analyzed. Here, a series of questions related to students' satisfaction regarding the

module content, level, and contribution to their future research work is evaluated. The following three questions about the quality of the module were included.

- How do you assess the quality of the lecturing?
- How do you assess the quality of the teaching material?
- Overall, on a scale of 1 to 10, (1 = very poor, 10 = outstanding), how do you evaluate the quality of this module?

The average level of satisfaction for modules was high, ranging from an average appreciation of 6.2 to 8.8 (on a scale from 1 to 10).

The third part of the evaluation form focuses on comments and suggestions for future events. Participants are asked to provide more elaborate feedback regarding what they have enjoyed or what could be improved in the summer school. Then, we focus on suggestions for possible future training initiatives, by asking for proposals of topics related to research methodology, statistical methods, and data analytics that might be interesting to integrate in our training offer.

Thanks to Kirkpatrick's (1998) Evaluation of Training levels, we first can measure trainees' satisfaction. Secondly, we assess if participants perceive that their knowledge or skills increased. Third, if participants' research performance has changed, they have a chance to provide detailed feedback. And, finally, there is an attempt to evaluate the trainings from an organizational point of view. The general purpose of collecting this information is to assess the effectiveness of all trainings and to use these findings to improve teaching and course material (Farjad, 2012). Furthermore, assessing the training benefits allows us to keep improving our offerings at the FSS and at other training events during the academic year.

OTHER FLAMES INITIATIVES

FLAMES also organizes an Annual Meeting (FAM), which highlights a specific topical theme. This academic year (2021–2022), for example, a hybrid meeting was held on data visualization (KU Leuven), where a day-long program was put together with nationally and internationally renowned speakers. Since 2015, FLAMES has also been involved every year in the Annual Meeting of the Belgian Association for Statistics in the form of sponsoring a day in the program. Both in 2015 (at the UAntwerp) and in 2016 (at the UNamur), a PhD Day was organized, during which groups of PhD students and post-docs could present their research in a poster session. FLAMES also presents an Award every two years to a person or institution that has made a valuable contribution to the application of statistical or methodological insights. In 2017, for example, the FLAMES Award was presented to the Institute for Nature and Forest Research during the FLAMES Annual Meeting.

CONCLUSION: INSIGHTS AND LESSONS LEARNED SO FAR

By using the "measuring is knowing" principle, hereby (additionally) focusing on the growing demand of interest by researchers, an increased number of teaching modules have been added in the last few years. To do so, FLAMES is supported on a yearly basis by government funds granted to each university. Thanks to this support, we are able to carry on with the training initiatives in methodology and statistics, hereby improving existing training materials and expanding new initiatives. A good example of the latter is the upcoming offering of new data science courses in 2022–2023 due to the increased popularity in this research field. By doing so, i.e., making consistent policy-mode, data-driven decisions within our network, the longitudinal analysis showed an increased number of participants in the last three academic years. Although there are countless possibilities for improvement and evolvement, we will continue our mission in statistical and methodological education.

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