

# **SEMANTIC**

end-to-end Slicing and data-drivEn autoMAtion of Next generation cellular neTworks with mobile edge Clouds

Marie Skłodowska-Curie Actions (MSCA) Innovative Training Networks (ITN) H2020-MSCA-ITN-2019 861165 - SEMANTIC



# **WP5 – Training**

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# **Executive summary**

This report summarizes the training activities, including feedback from early stage researchers (ESRs) and involved experts from the first (extended due to pandemic) year of activities. It reports on the School 1 and 2, and the Courses 1 and 2.



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# **List of Acronyms and Abbreviations**

Acronym	Description
$\overline{DoA}$	description of action
ESR	early stage researcher
WP	work package

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### 1 Introduction

Work package 5 (WP5) in SEMANTIC is responsible for planning, organizing and executing the training events, schools and courses of the project. This report summarizes the training activities, including feedback from the early stage researchers (ESRs) and involved experts from the first (extended due to pandemic) year of activities.

The planned training activities within SEMANTIC are as in Table 1.

Table 1. Planned training activities within SEMANTIC.

	Main Training Events & Conferences	ECTS	Lead Partner	Month
1	School 1: 5G architectures, enabling technologies, vertical industries and KPIs	no	NOKIA (ind)	M12→M14
2	School 2: E2e validation of 5G networks: key analytical, prediction, simulation, experimental tools	no	EUR (ac)	M12→M14
3	First SEMANTIC Industrial Dissemination Day	no	TLN (ind)	M13→ M19
4	Course 1: Intellectual skills, scientific writing and research integrity	no	UOA (ac)	M14→ M18
5	Course 2: Team skills, leadership, multi-cultural awareness and gender issues	no	PDT (ac)	M14→M18
6	First Workshop	no	CLM (ac)	M20→M19
7	School 3: PHY layer techniques and design principles in 5G New Radio	no	CLM (ac)	M20→M21
8	School 4: MEC-empowered service provisioning and integration in 5G networks	no	FOG (ind)	M20→M21
9	School 5: Emerging models and trends for dynamic network slicing and resource virtualization	no	CTTC (ac)	M24
10	School 6: Leveraging data analysis and machine learning for network management and automation	no	TLN (ind)	M24
11	Course 3: Influence, outreach and communication skills	no	IQU (ind)	M28
12	Course 4: IRP management and standardization	no	NOKIA (ind)	M28
13	Second SEMANTIC Industrial Dissemination Day	no	NI (ind)	M32
14	Second Workshop	no	EUR (ac)	M34
15	Course 5: Fundraising, Strategic Management and Entrepreneurship	no	TLN (ind)	M38
16	Final Conference	no	CTTC (ac)	M42
17	Plenary Meetings	no	CTTC (ac)	3 per year

In Chapter 2 we report on the first two schools, School 1 "5G architectures, enabling technologies, vertical industries and KPIs" and School 2 "E2e validation of 5G networks: key analytical, prediction, simulation, experimental tools", and in Chapter 3 we report on the first two Courses 1 "Intellectual skills, scientific writing and research integrity" and Course 2 "Team skills, leadership, multi-cultural awareness and gender issues".

All activities were held online, due to the pandemic, and the content of SEMANTIC Schools and Courses (slides, presentations, photos, etc.) are available to the ESRs in the SEMANTIC cloud



## 2 School 1 and 2

School 1 "5G architectures, enabling technologies, vertical industries and KPIs" and School 2 "E2e validation of 5G networks: key analytical, prediction, simulation, experimental tools" were composed of 16 speeches by 9 different speakers over 2+2 days Feb 16-19, 2021.

# 2.1 Agenda School 1

1st Day - 16th February 2021

Time	Speaker	Tentative Title	Syllabus
09.00-10.30	Dr. Dionysis Xenakis (FOG)	LTE and EPC system architecture and Evolution (LTE, LTE- Advanced, LTE- Advanced Pro)	-Figures on Network Usage -3GPP standardization - Key Technologies towards LTE/LTE- Advanced/LTE-Advanced Pro (Rel.8-Rel.14)
10.30-11:00			Coffee Break
11.00-12.30	Dr. Dionysis Xenakis (FOG)	LTE and EPC system architecture and Evolution (LTE, LTE- Advanced, LTE- Advanced Pro)	- Evolved Packet Core Architecture - E-UTRAN Architecture(s) - LTE(-x) protocol stack
12.30-14:00			Lunch Break
14.00-15.00	Dr. Charilaos Koumaras (NSCR)	5G system and Vertical Industries KPIs	- 5G Architecture and Technology Enablers - 5G Deployment Options - Vertical 5G KPIs
15.00-15:30	Coffee Break		
15.30-17.00	Dr. Charilaos Koumaras (NSCR)	5G system and Vertical Industries KPIs	- 5G Experimentation and Automation - 5G Trials of UAV industry - 5G Network Programmability



## 2nd Day - 17th February 2021

Time	Speaker	Tentative Title	Syllabus
09.00-10.30	Dr. Dionysis Xenakis (FOG)	5G Enabling Technologies (5GC)	- Intro to 5G and Figures - 5G Services Types - 5G Enabling Technologies (5GC)
10.30-11:00			Coffee Break
11.00-12.30	Dr. Dionysis Xenakis (FOG)	5G Core Network Architecture	- 5G Core Network Architecture (Rel.16)
12.30-13.30	NS. 31.		unch Break
13.30-15.00	Dr. Oemer Bulakci (NOKIA)	5G System, Vertical Integration, and Ecosystem Session 1	- Birth of a new Generation: 5G Flagship METIS Project Definiton of new Generation Current 3GPP Status IMT 2020 Validation of 5G KPIs 5GPPP IEG ITU-R Requirements 5GS Overview CN> SA2 RAN> RAN3 Management> SA5 E2E Network Slicing Foundation from Rel. 15, Rel. 16 Key Aspects of Slicing in Practice Rel. 17 Framework Briefly
15.00-15:30		(	Coffee Break
15.30-17.00	Dr. Oemer Bulakci (NOKIA)	5G System, Vertical Integration, and Ecosystem Session 2	- Vertical Support by 5GS Example Architectural Enablers for Vertical Support - Selected 5G Use Case Factory Automation Placeholder: Addition of New Use Case, if needed - Key Stakeholders 5GPPP Arch WG Brief Intro 5G Book Intro (Standardization and Research): 5GPPP Book



# 2.2 Agenda School 2

3rd Day - 18th February 2021

Time	Speaker	Tentative Title	Syllabus
09.00-10.30	Dr. Preben Mogensen (NOKIA)	Communication in the 6G era: use cases, requirements and technologies	- AI/ML native Air Interface (intro) - Spectrum aspects - Network sensing - Network architecture - Extreme networking & sub-networks - Privacy and security
10.30-11:00			Coffee Break
11.30-13.00	Dr. Jakob Hoydis (NOKIA)	Machine Learning for Future Communication Systems	- When (not) to use ML and how to identify good ML problems  - What can ML do for communications?  - Neural networks for receiver processing  - Introduction to end-to-end learning and autoencoders  - Three ways to train a neural network over a black-box channel  - Towards an Al-Native Air Interface for 6G
13.00-14:00		- 1	Lunch Break
14.00-15.30	Dr. Giovanni Neglia (INRIA, Sophia- Antipolis)	Online Learning with applications to Caching	Quick intro to gradient-based methods for convex optimization     Online learning and the concept of regret
15.30-16:00	Coffee Break		
16.00-18.00	Dr. Giovanni Neglia (INRIA, Sophia- Antipolis)	Online Learning with applications to Caching	- online gradient descent algorithm - application to caching problems

4th Day - 19th February 2021

Time	Speaker	Tentative Title	Syllabus
09.00-10.30	Dr. Dionysis Xenakis (FOG)	Stochastic Geometry	Introduction     Key Theorems and Basic Knowledge     SG for Wireless Network Modelling
10.30-11:00		C	offee Break
11.00-12.30	Mr. Nikolaos Episkopos (FOG)	Network Simulation Tools: NS-3	- NS-3 Overview - Main Libraries and Tools - Examples and Applications
12.30-13:30		L	unch Break
13.30-15.00	Florian Kaltenberger, Robert Schmidt (EURECOM)	Experimentation: OpenAirInterface	
15.00-15:30	Coffee Break		
15.30-17.00	Navid Nikaein, Robert Schmidt (EURECOM)	Experimentation: OpenAirInterface and Mosaic5G	



### 2.3 Survey results

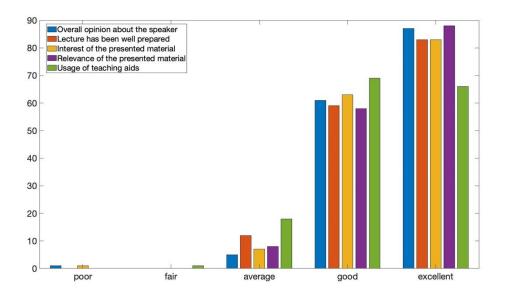


Fig.1. Overview of the feedback on School 1 &2.

In Fig. 1, we summarize the survey results for School 1 and 2. As can be seen, the seminars were almost all well received. All 14 ESRs responded (one ESR remains to be recruited in SEMANTIC).

#### **Comments from ESRs**

"Very effective lecture."

"Plenty of references that can be used in our research work were given."

"Also, very useful information about relevant standardization bodies and guiding lines about searching for technical specifications."

"A nice overview of almost any aspect of 4G systems that is good to know before diving into 5G."

"The teaching method was interactive and engaging."

"A very nice intro to 5G mobile networks."

"The second part about the enabling technologies was the most interesting part in my opinion."

"I think the information given about slicing was very important."

"Maybe the pace in the first part could be a little bit faster, because I think the ESRs are already familiar with this high level information and there was also a small overlap with the previous talk (regarding the content)."

"Again, a very interesting interactive and engaging lecture. Excellent lecture."

"I think the ESRs gained some insight information regarding 5G systems through it. Very useful resources-references were given. Excellent lecture."



"The insight information given regarding the use cases, requirements and technologies expected in the 6G era was very useful."

"Excellent lecture."

"The speaker provided very interesting examples of how machine learning can be applied to the air interface of 6G."

"Moreover, he provided great resources and responded clearly at any questions."

"Excellent and very useful lecture."

This was like a very compact course and despite the limited time the speaker managed to introduce us a new tool (OCO) in much detail and in a very clear way."

"It was a really good intro and I think that with the references, guidance and motivation provided it has become much easier for us to utilize OCO in our research work. Excellent presentation and material."

"Very interesting topic."

"Excellent presentation."

"The provided slides and explanations are a very useful starting point and guide for anyone that wants to use NS3 for simulations in his/her research work."

"Excellent presentation."

"I think that all the essential information was given in a very clear way for anyone who wants to start using this simulation tool."

"The demo presentation was pretty useful too."

"The description of what Mosaic5G offers now and what is planned for the future as well as the description of its main architecture was very useful."

"The same stands for the demo presentation"

"Well explained with use case."

"Well explained with examples."

"Good presentation and easily understandable especially for people new to NS-3."

"Too much content for the duration of the lecture."

"Too much content for the duration of the lecture."

"Nice and interesting."

"Very nice and interesting."

"The outlook on the topic discussed from an industrial point of view was very useful."

"Poor presentation overall."

"No effort/consideration for the listener/attendee."

"I liked interactive approach of the speaker."

"The quality of presented material needs improvement."

"The introduction on number of connected devices was repetitive as it was already discussed in the previous lectures."

"This lecture was very good."

"Thanks to Jakob."



"It was better if there were two time slots for this lecture."

"This lecture (E2E validation of 5G networks: key analytical, prediction, simulation, experimental tools) Could be interesting but unfortunately it was all theoretical and even all mathematical equations were not written in the slides."

"It was better if the lecturer talked about the basics and the importance of online learning and also how and when to use it."

"In machine lecture there are topics related to autoencoders, blackboxes, neural networks from literatures I reviews Causal inference is an emergence topic in technology. We should talk about it as well."

## 3 Courses 1 and 2

Course 1 "Intellectual skills, scientific writing and research integrity" and Course 2 "Team skills, leadership, multi-cultural awareness and gender issues" were held over 2+3 days June 7-11, 2021.

### 3.1 Agenda Course 1

Organizer: UOA.

1st Day - 7th June 2021

Time	Speaker	Tentative Title	Syllabus
09.00- 10.45	Lazaros Merakos	Papers Submission, Review Process, Publication Impact and Plagiarism	<ul> <li>Introduction</li> <li>Journals and Conferences (differences and classification)</li> <li>Impact factor</li> <li>Review process of journal and conference papers</li> <li>How to answer to reviewers' comments, with examples</li> <li>Double submission, resubmission and plagiarism (with focus on IEEE publications)</li> </ul>
10.45- 11:15			Coffee Break
11.15- 13.00	Lazaros Merakos	Papers Submission, Review Process, Publication Impact and Plagiarism	<ul> <li>Introduction</li> <li>Journals and Conferences (differences and classification)</li> <li>Impact factor</li> <li>Review process of journal and conference papers</li> <li>How to answer to reviewers' comments, with examples</li> <li>Double submission, resubmission and plagiarism (with focus on IEEE publications)</li> </ul>
13.00- 14:00			Lunch Break
14.00- 15.45	Luciano Baresi	Writing scientific papers	Introduction: why do we write papers?  How to prepare a paper contribution Structure of a research paper Concept and purpose How to present the ideas  Conclusions
15.45- 16:15			Coffee Break
16.15- 18.00	Luciano Baresi	Writing scientific papers	<ul> <li>Introduction: why do we write papers?</li> <li>How to prepare a paper contribution</li> <li>Structure of a research paper</li> <li>Concept and purpose</li> <li>How to present the ideas</li> <li>Conclusions</li> </ul>



#### 2nd Day - 8th June 2021

Time	Speaker	Tentative Title	Syllabus
09.00- 10.45	Ferran Adelantado i Freixer	Hands on presentations	<ul> <li>Introduction - objectives</li> <li>Preparation of presentations</li> <li>Execution of presentations</li> <li>Comments / corrections</li> <li>Conclusions - lessons learnt</li> </ul>
10.45- 11:15			Coffee Break
11.15- 13.00	Ferran Adelantado i Freixer	Hands on presentations	<ul> <li>Introduction - objectives</li> <li>Preparation of presentations</li> <li>Execution of presentations</li> <li>Comments / corrections</li> <li>Conclusions - lessons learnt</li> </ul>

### 3.2 Agenda Course 2

Organizers: POLITO, FOG, UOA

COURSERA MOOC - Intercultural Management [1] with Readings material [2].

Zoom (with breakout rooms) was used for the interactive sessions.

#### June 9, 2021 9:00-17:30

#### 9:00-9:15 Welcome to the SEMANTIC Course 2

#### 9:15-13:30 Introduction

9:15-10:05

1. Video: Introduction – Opening - Duration: 7 min

2. Video: Globalization and Culture - Duration: 8 min

3. Video: The Concept of Culture - Duration: 10 min

4. Video: Cultural Dimensions - Duration: 15 min

5. Video: Intercultural Management Skills - Duration: 7 min

10:05-10:55 Reading

ESR Group 1

Reading: Contemporary Developments in World Culture (W1-R02.pdf)

Reading: The Triangular Trade and the Atlantic Economy of the Eighteenth Century (W1-

R05.pdf)

ESR Group 2

Reading: The globalization of markets (W1-R10.pdf)

Reading: A quarter century of culture's consequences: a review of empirical research incorporating Hofstede's cultural values framework (W1-R09.pdf)

ESR Group 3

Reading: Cultural intelligence. A theory-based, short form measure (W1-R13.pdf)

Reading: Universals in the Content and Structure of Values: Theoretical Advances and Empirical Tests in 20 Countries (W1-R12.pdf)



10:55-11:05 Break

11:05-13:30 Interactive Session

11:05-12:00 Each group prepares a short presentation (max 15 min) on their assigned readings about Introduction and Intercultural Teams and Leadership

12:00-12:30 ESR Group 1 Presentation and discussion

12:30-13:00 ESR Group 2 Presentation and discussion

13:00-13:30 ESR Group 3 Presentation and discussion

13:30-14:30 Lunch Break

14:30-15:00 Quiz on Part 1

#### 15:00-15:45 Intercultural Teams and Leadership

1. Video: Introduction - Duration: 2 min

2. Video: Intercultural Encounters and Self-Awareness - Duration: 5 min

3. Video: Managing Diversity - Duration: 11 min

4. Video: Managing Intercultural Teams - Duration: 12 min

5. Video: Leadership in an Intercultural Organization - Duration: 9 min

15:45-15:55 Break

#### 15:55-16:45 Reading

ESR Group 1

Reading: The Impact of Leadership and Change Management Strategy on Organizational Culture (W2-R01.pdf)

Reading: What Leaders Really Do (W2-R12.pdf)

ESR Group 2

Reading: Cross-cultural Management Research: Assumptions, Evidence and Suggested Directions (W2-R06.pdf)

Reading: What Leaders Really Do (W2-R12.pdf)

ESR Group 3

Reading: Leadership That Gets Results (W2-R07.pdf)

Reading: What Leaders Really Do (W2-R12.pdf)

#### 16:45-17:30 Interactive Session

16:45-17:30 Each group prepares a short presentation on their first Reading (10 min) and will get ready to discuss both Readings.

#### June 10, 2021 9:00-17:30

#### 09:00-10:30 Interactive Session

09:00-09:30 ESR Group 1 Presentation and discussion

09:30-10:00 ESR Group 2 Presentation and discussion

10:00-10:30 ESR Group 3 Presentation and discussion



10:30- 11:00 Quiz on Part 2

11:00-11:10 Break

11:10-13:30 Intercultural HRM

11:10-12:10

1. Video: Introduction - Duration: 6 min

2. Video: Intercultural Mobility - Duration: 15 min

3. Video: Intercultural Recruitment and Selection - Duration: 9 min

4. Video: Cultural Dimensions of Talent Management - Duration: 12 min

5. Video: Intercultural Rewards - Duration: 13 min

12:10-12:20 Break

12:20-12:50 Reading

**ESR Group 1** 

Reading: Evolving and enduring Challenges in Global Mobility (W3-R02.pdf)

ESR Group 2

Reading: Changing Patterns of Global Staffing in the Multinational Enterprise: Challenges to the Conventional Expatriate Assignment and Emerging Alternatives (W3-R03.pdf)

**ESR Group 3** 

Reading: Strategic Issues and Local Constraints in Transnational Compensation Strategies: An Analysis of Cultural, Institutional and Political Influences (W3-R06.pdf)

12:50-13:30 Interactive Session

12:50-13:30 Each group prepares a short presentation (max 10 min) on their assigned readings about Intercultural HRM

13:30-14:30 Lunch Break

14:30-15:30 Interactive Session

14:30-14:50 ESR Group 1 presentation and discussion

14:50-15:10 ESR Group 2 presentation and discussion

15:10-15:30 ESR Group 3 presentation and discussion

15:30-16:00 Quiz on Part 3

16:00-16:10 Break

16:10-17:00 International Marketing Decisions

1. Video: Introduction - Duration: 10 min

2. Video: International Product Decisions - Duration: 8 min

3. Video: International Promotion Decisions - Duration: 9 min

4. Video: International Place Decisions - Duration: 9 min

5. Video: International Pricing Decisions - Duration: 11 min

17:00-17:30 Reading

ESR Group 1



Reading: Nature of international marketing (chapter 1, W4.pdf)

ESR Group 2

Reading: Culture (chapter 6, W4.pdf)

ESR Group 3

Reading: Trade distortions and marketing barriers (chapter 3, W4.pdf)

#### June 11, 2021 9:00-17:00

#### 09:00-10:45 Interactive Session

09:00-09:45 Each group prepares a short presentation (max 10 min) on their assigned readings about Intercultural HRM

09:45-10:05 ESR Group 1 presentation and discussion

10:05-10:25 ESR Group 2 presentation and discussion

10:25-10:45 ESR Group 3 presentation and discussion

Break 10:45-10:55

10:55-11:25 Quiz on Part 4

#### 11:25-12:15 Intercultural Business Negotiations

1. Video: Introduction - Duration: 8 min

2. Video: Goals and Negotiation Approaches - Duration: 11 min

3. Video: Foreign Language Use: Proficiency and Anxiety - Duration: 8 min

4. Video: Style of Language: High-Context vs. Low-Context - Duration: 8 min

5. Video: The Role of Teams in Intercultural Business Negotiations - Duration: 9 min

12:15-12:25 Break

#### 12:25-12:45 Reading

**ESR Group 1** 

Reading: Cultural accommodation and language priming: Competitive versus Cooperative Behavior in a Prisoner's Dilemma Game (W5-01.pdf)

ESR Group 2

Reading: The Multifaceted role of Language in International Business: Unpacking the Forms, Functions and Features of a Critical Challenge to MNC Theory and Performance (W5-R02.pdf)

ESR Group 3

Reading: The ambiguous Role of cultural Moderators in Intercultural Business Negotiations (W5-R06.pdf)

#### 12:45-13:30 Interactive Session

12:45-13:30 Each group prepares a short presentation (max 10 min) on their assigned readings about Intercultural Business Negotiations

13:30-14:30 Lunch Break

#### 14:30-15:30 Interactive Session



14:30-14:50 ESR Group 1 presentation and discussion

14:50-15:10 ESR Group 2 presentation and discussion

15:10-15:30 ESR Group 3 presentation and discussion

15:30 -16:00 Quiz on Part 5

16:00 -16:10 Break

16:10-17:00 Wrap up

16:10-16:20 Wrap up: 1 video (7 min)

16:20-16:50 Final Quiz

16:50-17:00 Closing remarks

### 3.3 Survey results

In Fig. 2 and Fig. 3, we summarize the survey results for Courses 1 and 2, respectively. As can be seen, Course 1 was well received, whereas there were concerns about Course 2. In total 13 ESRs responded (one ESR remains to be recruited in SEMANTIC).

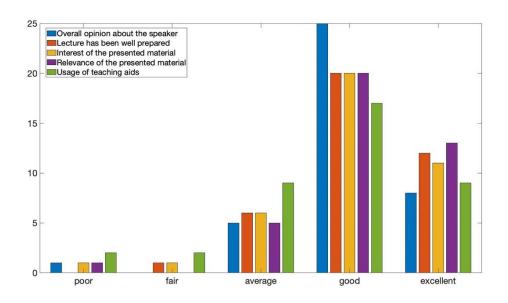


Fig.2. Overview of the feedback on Course 1.



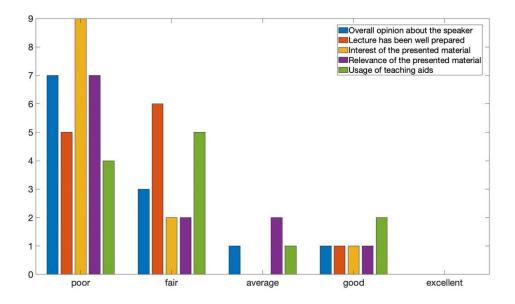


Fig.3. Overview of the feedback on Course 2.

#### **Comments from ESRs**

"Coursera contents are good, but we expect more. One of the disappointed things in this course, we had given several presentations in each day by reading some difficult papers which are totally out of our zone and fields and not useful at all. Positive thing is, we had able to build our team skills and interaction by this course, but overall, not so good."

"The course was extremely time-consuming without any significant gain for our skills or knowledge. The material was not interesting for me. Moreover, the time to read and make the presentations was very limited, so it was not possible to understand the reading material. I believe that there could probably be some more meaningful way to enhance our team skills. However, I understand that the current situation with Covid must have limited the options"

"In general, the subject was not interesting, the context was not helpful, the way to teach us on Coursera was worse. I can say, it was just wasting time. Please consider our opinions as an ESR."

"What we did during the three days of this course could be written in dictionaries as a practical definition of wasting time! one week later (even today), if you ask the participants to write a paragraph on what they learned or what was added to them during this course (not using videos or papers they have in their laptops) no one can write anything. The overall gain of this planned!!! course was absolute zero."

"The course was quite intensive and some videos from Coursera were irrelevant. Also, the reading material were voluminous for the allocated time slots and could have been replaced by interactive sessions and discussion as opposed to presentation-discussion. Nevertheless, the course gave opportunity to collaborate and interact with other ESRs. The peer grading was not really useful but rather caused disagreements among the ESRs."

"In my opinion the course was poorly organized and managed. Each and single part of the course has no particular beneficial purpose for the ESR – for example, like final evaluation made by students – what is the purpose of that, and why is it even done, to show who was good and who was bad, and then what? How do we understand the marks? Although, the Coursera itself is a great educational platform, I believe that it does not match to the high standards of the training part of the ITN Marie Curie fellowship. While multicultural



management is one of the key parts of our project, this particular way of training has given me a negligible added value to the skills and knowledge."

"Reading various materials spanning over more than 100 pages were not useful at all. In fact, within the provided time, I found it difficult to grasp the general idea discussed in those materials. Moreover, the idea of training the ESRs through a course from Coursera was not a great idea."

### 4 Conclusions

The first year (extended due to the pandemic) of the SEMANTIC Training activities have been implemented with the scope as planned in the DoA (with two months delay for School 1 and 2, and three months delay for Course 1 and 2 due to the pandemic). School 1 & 2, and Course 1 were well received by the ESRs. This is especially encouraging, given that all activities were held online due to the pandemic. Course 2 could however been better received, which must be taken into account in the planning of the coming training activities.

### 5 References

- [1] COURSERA MOOC Intercultural Management. Online: https://www.coursera.org/learn/intercultural#about
- [2] COURSERA MOOC Intercultural Management, readings material. Online: https://www.dropbox.com/s/dk2u7lc0mfr6am4/SEMANTIC-school-papers.zip?dl=0