SHOULD BIG DATA RULE TOMORROW'S WORLD?

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Abstract

How can future IT leaders be best prepared to address tomorrow's challenges and opportunities brought by Big Data developments? The one-week digital seminar addressed to a group of highly performing computer science Master students from four countries, organized digitally in Passau (Germany) at the end of February 2021 in the frame of the FIT Europe (*Future IT Leaders for a Multicultural Digital Europe*) Project was a concrete European answer to this question. The one-week seminar was an output of the cooperation from Passau University (Germany), INSA Lyon (France), the University of Milan (Italy) and Politehnica Bucarest (Romania) and two industry players active in Artificial Intelligence and Big Data: digital leader ATOS Germany and start-up hub La French Tech One Lyon Saint-Étienne. This initiative had an original format: addressed to a group of French, Romania, Italian and German students, it involved academic experts from various fields and IT professionals to train students not only on the technological developments to be expected on Big Data, but also, even more, on the future societal and ethical challenges and opportunities raised by these innovations. In the end, this initiative managed to also make use of the opportunities brought by digitization to successfully stimulate reflections and interactions.

Keywords: ERASMUS +, education, master students, Artificial Intelligence, AI, IoT, Big Data.

1 INTRODUCTION

A relaxed discussion among Master students and professional experts from Romania, Italy, Germany and France seated around a fireplace: an impossible scene in February 2021 at the very heart of the Corona-pandemic? Well digitally, anything is feasible. And indeed, on the 23rd of February 2021 Kseniia, Alexandru, Salim and Davide are having a fireside chat with their two mentors from Romania and Germany while each sitting comfortably at home, in Lyon (France), Bucharest (Romania), Milan (Italy) and Passau (Germany).

It is the first day of the FIT Europe Seminar hosted digitally by the University of Passau (Germany) with Institut National des Sciences Appliquées INSA Lyon (France), Università Milano Statale (Italy) and Politehnica Bucarest (Romania) together with European digital leader ATOS Germany and start-up hub La French Tech One Lyon Saint-Étienne. On this day students, mentors and experts are gathering to get to know each other. They laugh, exchange ideas about this week's topic "Should big data rule tomorrow's world?" and discuss how to organize themselves in order to work further together during the next days. If one of them leaves the discussion, he/she can simply move to another room, meet other participants and possibly join or start a new conversation: just like in any conference coffee break.

This real discussion – taking place in the virtual, cozy living-room enabled by the digital tool Wonder – was happening at the first one-week seminar organized by the University of Passau with its partners within the EU-funded "Future IT Leaders for a Multicultural Digital Europe – FIT-Europe" Erasmus+ project [9]. The aim of this initiative was to give a group of 20 high-performing computer science students from 4 European countries the chance to get an innovative European training in order to be best prepared to tomorrow's challenges and opportunities related to the development of Big Data. This paper will explain what the concept was behind this innovative higher education European offer and the methodology that was followed. The aim is to invite other higher education institutions to learn from this experience and stimulate others to replicate this good practice or improve it even further.

The next section details the objectives of the project in general, and of the first FIT Europe seminar. Section 3 presents the methodology that was used to structure and to organize the seminar, as well as how we approached the challenge of moving the seminar to an online format. Section 4 details the participants in the seminar and the feedback that was received following the seminar. The last section draws the conclusions.

2   PROJECT OBJECTIVES

What are the FIT Europe objectives?

The *Future IT Leaders for a Multicultural Digital Europe* (FIT Europe) Project is an EU-funded project aimed at designing and implementing an innovative transnational curriculum for computer scientists in Europe.

Launched in October 2019 by four European higher-education bodies educating computer scientists at Master level, the three-year project aims at bringing a concrete answer to a double question: what will be tomorrow's challenges future IT leaders will meet? and how can we best prepare them for these tasks?

As an answer, the FIT Europe concept relies on a set of 4 one-week "seminars" addressed to highly performing computer science Master students from the four participating countries. Each seminar is shaped based on a double principle.

First, each seminar proposes an innovative topic as it prepares students for future burning issues, such as: what will be the place of robots in a multi-generational society? Should Big Data rule tomorrow's world? What will be the business interest of blockchain technology? How may "Internet of things" respect people's private lives and trust in IT? Or what innovations may rise from these new technologies and how will we address the new societal issues they raise?

Second, FIT Europe is also innovative in terms of how these themes are dealt with together with the students, as it relies not only on a European approach of the issue thanks to the cooperation from academic experts from the four partner higher education institutions but also on a strong connection with IT economic players. In FIT Europe, industry and academia are working hand in hand not only when designing but also when implementing the program. Hence, students are not only coached by academics, but also by players active in the IT business, with whom they carry out projects connected to real challenges.

Why Big Data?

The Seminar digitally hosted by the University of Passau from 22nd to 25th February 2021 was the first FIT Europe seminar. It focused on the future technical, societal and ethical dimensions of Big Data and invited students to reflect on whether "data should rule tomorrow's world".

The Covid-19 pandemic has illustrated how Big Data has become an essential component of our society. Various Corona-apps have been developed in European countries, to help fight against the propagation of the virus. Anyone has been invited and has become used to regularly checking graphs on official websites reflecting the daily evolution of Corona cases. Statisticians and data scientists have become the new *influencers*, their predictions having an exceptional impact – bigger than economic or political interests – on society's rules and organization. And data have been exchanged to an unprecedented level among countries on the lack of respirators or the saturation of hospitals, but also on the Covid-19 virus' variants and the best treatments to combat the pandemic. Thus, what we observe echoes well what bio-science and pediatrics Professor Atul Butte was already confessing in 2012: "*Hiding within those mounds of data is knowledge that could change the life of a patient and change the world. If I don't analyze those data and show others how to do it, I fear that no one will.*" [1]

If the added value of Big Data is not to be demonstrated to our computer science students, its risks may be less visible to them. As the societal and ethical aspects of Big Data (and, related, of Artificial Intelligence) start being more and more discussed in the European society, our students and future IT leaders should also be prepared to encompass these dimensions and address these in their work. As already warned by George Orwell 70 years ago in his famous *1984*, Big Data presents the risk of encroaching our freedom; it threatens our privacy and security and comes with several associated ethical concerns.

Thus, our role as higher-education institution is to educate students and equip them with the necessary competences and skills so that they are ready to embrace the opportunities but also the challenges raised by the development of Big Data. These challenges are related, in particular, to the environmental cost of the development, processing, and storage of data, the lack of clarity of artificial intelligence and consequences this can have, such as discrimination and errors, and the social inequalities regarding access to digital tools and skills and to the new ways of working that Big Data leads to. There are also the moral and philosophical questions such as the responsibility of data-based processes and choices.

Providing these skills was the aim of the international one-week seminar organized at the end of February 2021.

3   METHODOLOGY

Trans-disciplinarity, multiple expertise and variety of formats

Instead of a usual academic meeting, where students exchange with other students and academic professors, the FIT Europe Passau Seminar was a one-week package of trainings on a variety of issues with the involvement of a broad spectrum of professionals. The 20 highly performing computer science students, coming from the four higher education institutions involved, were not only trained by computer scientists on the possible technological developments that will take place in the coming ten to twenty years on Big Data, but also by lawyers, philosophers, human resources and business specialists on the impact these developments will have on tomorrow's society, which they will also face as future IT leaders. And it followed an innovative and interactive format that combined presentations, exchanges and joint work among international students and experts.

This set-up reflected well the methodology of the FIT Europe Passau seminar: on the one hand, a trans-disciplinary approach widening the academic approach usually offered to computer science Master students, and opening their knowledge and skills on ethical, societal, legal and even human resources issues; on the other hand, the deep involvement, not only of academic experts but also of professionals coming from the private sector; and finally, a mix of formats and tools supporting international exchanges among participants, enabling students to work in international teams, discuss with their mentors, meet other students, have bilateral discussions with other professionals or attend plenary sessions.

As a result, a "typical" day during the FIT Europe Passau Seminar saw students discuss with professionals about how AI will impact our society's values, reflect a few hours later about future diversity and multi-generational cooperation in the data leaders' workplace, meet their mentors for a bilateral exchange, and address in the late afternoon the problem of liability and rights for AI within autonomous driving, thanks to the training delivered by a lawyer specialist of this field.

In addition, the students formed 5 international teams (each team included a student from each participating higher education institution), which worked the whole week to develop a project answering the overarching question related to the topic of the seminar – "Should Big Data rule tomorrow's world?" Each team was invited to go deeper into a specific sub-question, such as "Is digitization a poisoned gift for the environment?", "Is the digital era an added-value for tomorrow's Europe?", "What are the lessons from the Covid-19 crisis for the role of big data on healthcare?" and many others. But students could also choose another sub-topic, and the results from the 5 international teams of students reflected a real diversity of approaches.

For this task, the students were not left alone: each team was helped by a pair of two "mentors" who guided them in their project. These mentors included academics from the 4 participating institutions (Prof. Harald Kosch, Dr. Armin Gerl, Dr. Wiem Fekih Hassen, and Claudia Heudecker from Passau University; Prof. Lionel Brunie from INSA Lyon; Dr. Andrei Olaru and Dr. Alex Awada from Politehnica Bucharest; and Dr. Stelvio Cimato from Uni Milan), but also professionals: Roland Wossidlo from ATOS and Dr. Amélie Cordier from La French Tech One, the two industry partners deeply involved in this seminar. *"Some students worked through the night and sent me emails to ask me questions at 2 o'clock in the morning"* enthusiastically highlighted Dr. Amélie Cordier. *"It is amazing and really great how they got involved!"*

At the end of the week, all students' teams presented their work in front of the FIT Europe participants. *"We had no idea what the students would deliver"* confessed Dorothée Brac de la Perrière, who manages the FIT Europe project at INSA Lyon. *"The results were stunning, both in terms of the quality of what the students proposed, as well as regarding the originality of their presentation. Some even developed a whole separate website around their proposal. We were all speechless!"*

The participating students were, actually, not the only ones who benefited from such cross-linking conversations: the academic and industrial partners also discovered new angles for tackling these issues, through their exchanges with these promising students. *"What an honour! Thanks for having the team of ATOS today in FIT Europe program and speak about people challenges in the modern world."*, tweeted enthusiastically the ATOS team, after a very interactive session with FIT Europe participants on the human resources management impact of the current digital revolution, and what skills managers will need to have in the future.

Digital set-up

"Supporting as much as possible contacts and exchanges among our participants – not only among students, but also among students and professionals – was fundamental for us" highlight the organizers within the team of Professor Harald Kosch at the University of Passau (Germany). *"Actually, when we asked our participants from France, Germany, Italy and Romania: what do you expect the most as a result of this event? The top answer that came out was: to get to know new people. And we offered the possibility to meet very various people, not only in terms of nationality, but also in terms of generation and background."*

Figure 1. Discussing in Wonder [TODO] around several tables.

These expectations had to be met despite the social distancing context: enabling interaction and networking among people who have never met in real life, who come from all over Europe, and who are diverse in terms of profile (students, academics or professionals from industry players) is a challenge when people cannot meet "for real". The seminar was initially supposed to take place at the University campus in Passau, where visiting students and professionals would have been welcomed and accommodated for the duration of the one-week seminar. But as the pandemic progressed, new scenarios had to be envisaged, leading also to hybrid solutions depending on the limitations in the various countries: for instance, whereas in Passau, everything had to be digital as students were not allowed to come to the Campus, in Lyon participants gathered in a meeting room at INSA and collectively attended (with masks and social distance) the online event – in a hybrid format.

While bringing participants together in a face-to-face seminar is easy, because all you need is one or several rooms, computers, and projection screens, creating an engaging experience digitally can be challenging [3]. There were several aspects that needed to be covered in order to ensure a good communication and appropriate involvement of the students: a means to watch and intervene in presentations by the speakers, a means to discuss while associating freely into groups, a means to collaborate on project work, a means to get quick feedback and test general involvement of the students, and a means for students to get access to materials related to the presentations.

We have covered these aspects using several tools. We have used Zoom for the presentations and main interaction with the students during the presentations [4]. This ensured easy access for participants in different institutions, and the ability to record the meetings.

For allowing students to discuss at the beginning of their project work we have used Wonder – a web application that allows participants to "sit" at tables and communicate via video and audio with the other people at their "table" [6]; participants can move freely between tables (see Figure 1).

For obtaining quick, anonymous feedback on the activities in the seminar, or to get answers to questions evaluating the attentiveness of participants, we have used Mentimeter, a web application that supports engagement [5].

Finally, in order to allow access to materials (slides, videos) at all times, and also to enable a shared environment in which teams can store their own files, we have set up the FIT Europe Multi-Media Library, powered by Moodle [7], as a content library, complete with group-based access, content tags, calendar,

and many other features [8]. The library was gradually enriched throughout the seminar with content and information about the speakers.

The FIT Europe Passau Seminar did not only support students to meet among themselves, it also stimulated real exchanges and joint work with the external experts as well. The result was very satisfactory. "*When I see our students from Lyon together with students from Bucharest, Passau and Milan reporting in a same team after having worked together for a whole week, this is really Europe*" enthusiastically noted Prof. Lionel Brunie, head of the Computer Science Department at INSA Lyon on the last day of the one-week seminar. "*Our students learned a lot from the interactions they had with the other students and with the researchers and industry experts they met during the seminar week.*"

4 PARTICIPANTS AND RESULTS

The participants in the first FIT Europe seminar were 20 students (5 students from each partner higher education institution), 9 speakers (7 from higher education institutions and 2 from industry partners), 10 mentors for the international teams (8 from higher education institutions and 2 from industry partners), and several people engaged in the organization of the seminar, also handling technical issues and issues related to student engagement.

Most of the students showed a high degree of involvement, asking questions during the presentations and initiating discussions which were highly relevant to the challenges posed by the advent of Big Data and related technologies, demonstrating a real interest to the core principle of the seminar – not only dealing with the scientific field of Big Data, but also with the connected challenges in terms of ethics and society.

The involvement of the students was demonstrated by their work in the international teams, which developed their own questions that need discussion, and produced insightful presentations in the last day of the seminar. The students discussed questions and challenges such as "Is digitalization a poisoned gift for the environment?" – dealing with the carbon footprint of data processing and remote working; "Big data and government transparency" – dealing with the challenges of placing big data tools in the hands of governments; "Data-driven sustainable development, possible or utopic?" – dealing with challenges related to the privacy of big health data; "How do filter bubbles influence people's opinions during the corona pandemic?" – dealing with the management of news and information items in search and social media; and "Data immunization program" – dealing with privacy and awareness in the use of social media. These topics elicited a very good response from all the participants in the seminar and lead to relevant discussion.

Several weeks after the seminar, a feedback form was sent to all participating students. The questions were related to the relevance of the topics presented by the speakers, to the utility of the project work (done by the teams), and to the tools that were offered for interaction between participants.

The feedback was very positive with respect to the core goals of the seminar. 83% of the students felt that they learned a lot in the ethical / societal field, 67% of the students felt that they learned a lot in the business field, and all the students felt that they learned at least a few things in the legal field. This meant that the target of cross-disciplinarity was well achieved.

Regarding the work in teams, two thirds of the students saw it as a great addition to the seminar, that increased involvement and interest.

We were very glad to observe that the digital set-up of the seminar did not hinder interactions: on the contrary, it offered some flexibility that was much appreciated by many. In the students' feedback, 83% of the participating students found that the possibilities of networking between students that were offered in during the seminar were enriching or very enriching; the ratio is also very high (75%) regarding the possibilities of networking with the experts.

Moreover, as one of the student teams showed, the digital format has less negative impact on the environment than a seminar "in real life". When one professor asked smartly: *"But finally what would you prefer: that the next FIT Europe seminar takes place face-to-face in the beautiful city of Lyon or in digital format?"*, the answer to this question was not unanimous nor straight-forward: our future IT leaders will have to intelligently tackle this diversity, and not forget the human perspectives digitization will never replace.

5 CONCLUSIONS

The FIT Europe Passau Seminar on "Should Big Data rule tomorrow's world" offered to a group of 20 Masters students from France, Italy, Romania and Germany at the end of February 2021 was an attempt to bring a concrete European trans-disciplinary and broad high-quality training to future IT leaders. Contrary to the "classical" set-up of such seminars, it relied on the idea that our computer science students will need to face not only technical, but also ethical and societal challenges for which they are not enough prepared in the classical curriculum they follow.

When speaking with data scientists, we hear that these professionals already start facing ethical, legal or societal questions that they must tackle but for which they are not enough prepared in relation to Big Data [2]. Therefore, there is a need to develop further such academic offer. The FIT Europe experience demonstrates that the European cooperation of various higher education institutions and industry partners offers an optimal set-up to adequately fulfil this mission.

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