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D.5.3. Report on evaluation of developed academic materials during the NEMO Summer Schools¹


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1 Introduction

The DigiFoF WP5 package “The Factory of the Future Designer: Academic Programs” aims at creating, in a collaborative manner, guideline regarding establishing a joint Master program between HEIs and industry in the field of manufacturing digitalization and Factory of the Future (FoF) based on multi-fold experiences:

- a) Each HEI contributes by creating courses using the new materials, tools and advanced laboratories, support the creation of the academia-industry exchange framework, organizes student mobilities and contributes to the creation of the guidelines for the joint industry-academia Master. Some of staff from HEIs partners prepares lectures and exercises and will teach at the summer school.
- b) EMSE as WP leader, besides coordinating tasks, collaborates with UNIVIE and OMiLAB in the organization of NEMO summer schools (invites lecturers, designs program, plans teaching materials), organizes mobilities of staff and students, conduct lectures and exercises at NEMO summer schools and prepares OMiLAB with tools and functionalities for supporting lectures and exercises.
- c) From the individual knowledge exchange between academia and industry, the project partners will design in this task, guidelines for the creation of a Master program applicable for the design aspects of the Factory of the Future and for modernising HEIs curricula.
- d) The guidelines will contain all information necessary to create a curriculum (target group, prerequisite knowledge, competences and skills to be delivered, types of courses, structure, syllabi).

This report details the actions carried out by DigiFoF partners from joint academia-industry point of view by analysing the academic materials developed and presented during the NEMO Summer Schools (2020 and 2021).

Conducting the evaluation report of developed academic materials during the NEMO Summer Schools respects Quality Assurance plan that was set by the D6.1 deliverable which provides guidelines on the event organization and standards to ensure consistency between the events organized by the project partners.

The evaluation report structure consists in:

- Using the D6.1 to create NEMO evaluation report structure and content
- Applying the NEMO evaluation report in July 2020 and reviewing by OMiLAB
- Collecting feedback and update accordingly the deliverable D5.3 and providing QA report by OMiLAB
- Repeating the process for 2021

The NEMO 2020 organisers (University of Vienna - Austria and OMiLAB) provided with at least 6 months before the event a full information package to all potentially participants

(<https://NEMO.omilab.org/NEMO/call-for-participation/>). This includes agenda, information about the venue and how to reach it (suggested hotels, public transports available, etc.), link to online conference software (in case of webinar), material and tools required. Time for preparation activities depends on the event type (e.g. summer school, workshop or trainings).

A feedback form shall be distributed to all the event participants. This will be based on the guidelines of Q6.1 annex C and will be presented during this deliverable (D5.3).

The organizers are responsible for reporting the collected feedback using the DigiFoF standard template (annex D). This template has to be filled by organizers. It shall be used to inform colleagues and partners about events (NEMO 2020 and NEMO 2021 respectively).

2 How affect the COVID-19 challenge the DigiFoF project from perspective of NEMO summer school. Measures to mitigate!

Unfortunately, the sanitary conditions caused by the COVID-19 pandemic prevented the 2020 Next-Generation Enterprise Modelling (NEMO) summer school from taking place. This has caused disappointment among both students, teachers and organizers.

Through the NEMO Day event from 29.01.2021 we set out to initiate a series of online events to make up for the loss of the summer school of 2020 but also to test to what extent online teaching methods can replace physical teaching face to face, if there is interest from the students' part, how the courses are appreciated and understood, etc.

Judging by the large number of participants but especially by the number of questions at the end, I think the event has reached its goal. In addition, I was pleasantly surprised by the depth of the students' questions and especially by the new suggested research ideas that we will study, analysing them in our research groups.

One thing is for sure, NEMO Day should not remain a singular event but should continue, maybe even extending the target audience toward companies activating in the Manufacturing sector but not only!

Adrian Florea, Technical Coordinator of DigiFoF project

3 NEMO Day – January 2021: DigiFoF Edition

Following the NEMO Summer School Series, the NEMO Day 2021 aims to provide participants insight into the EU project DigiFoF, results achieved, and further development activities within this project and the OMILAB network. Moreover, the NEMO Day 2021 will give participants an idea of the two-week event, namely the NEMO Summer School, that usually takes place at the end of July at the University of Vienna.

The NEMO Summer School Series focuses on the design and implementation of Enterprise Digital Twins and Ecosystems based on conceptual modelling methods. NEMO provides a vertical overview across different application domains as preparation for all dimensions of digitization.

The NEMO Day 2021 was organized by the DigiFoF project to elevate student's expertise in design aspects of the factory of the future and gain insights on the applicability of developed design artefacts, methods and tools. Participants had the chance to interact with experts in the field, provide their reflection as an evaluation and were awarded a learning badge.

All details related to the event can be found online at: <https://www.omilab.org/activities/events/NEMOday2021/>

Presentations given during the NEMO Day 2021 are presented in the table below:

Presentation	Presenter(s)
Introduction DigiFoF Project	Prof. Dr. Adrian Florea, Lucian Blaga University of Sibiu, Romania
Design of Product Service Systems supported by Conceptual Models	Prof. Dr. Xavier Boucher, Mines de Saint-Etienne University, France
Conceptual Models of Production Processes	Prof. Dr. Adrian Florea and Prof. Ion Mironescu, Lucian Blaga University of Sibiu, Romania

Number of registered participants was 54 from 10 different countries and 13 organisations. After the event participants were asked to fill a questionnaire to evaluate event. Questionnaire was divided in five parts:

1. Satisfaction in various aspects
2. Agreement to statements
3. Yes/no questions
4. Miscellaneous multiple-choice question
5. open questions.

The questions presented in the evaluation form are presented in appendix A. Results from multiple choice questions are presented below.

3.1 Participant feedback

In next charts the x axes represent the satisfaction degree with values from 1 (not satisfied) to 5 (very satisfied).

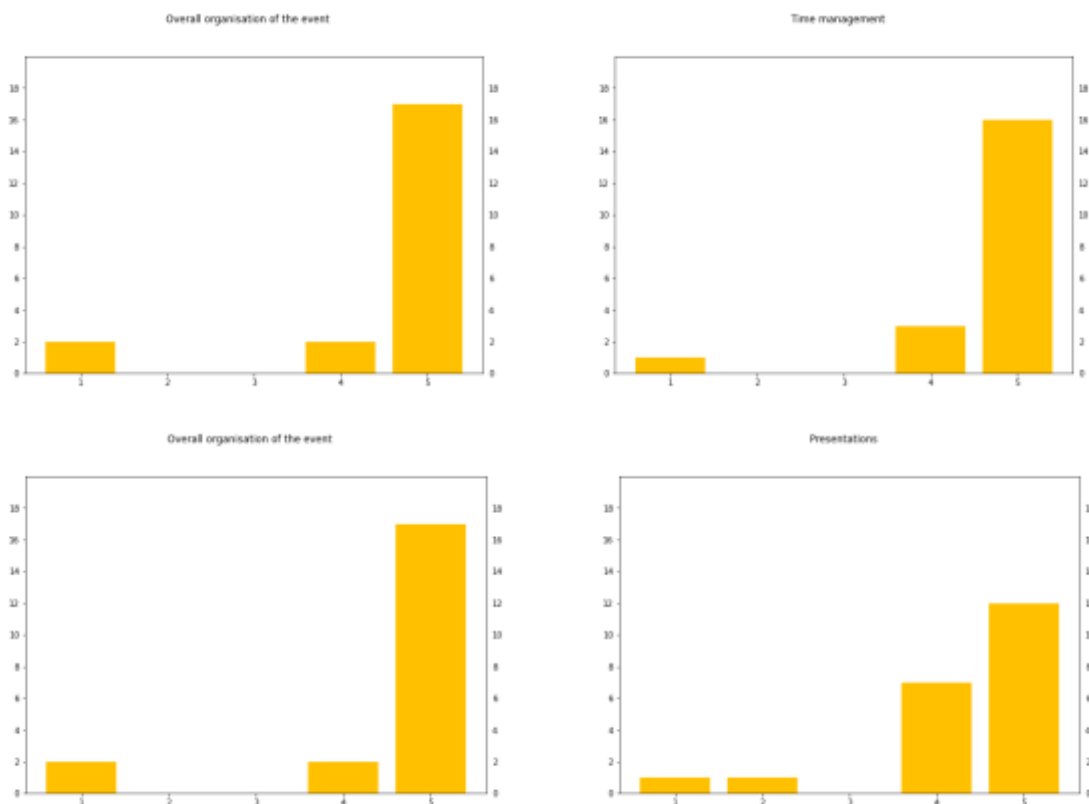


Figure 1: The overall satisfaction in the event

Participants were highly satisfied in organisation of event. In every aspect event gained mostly highest score. Only the satisfaction in presentation had significant number of score one point lower than maximum. Overall event was very successful

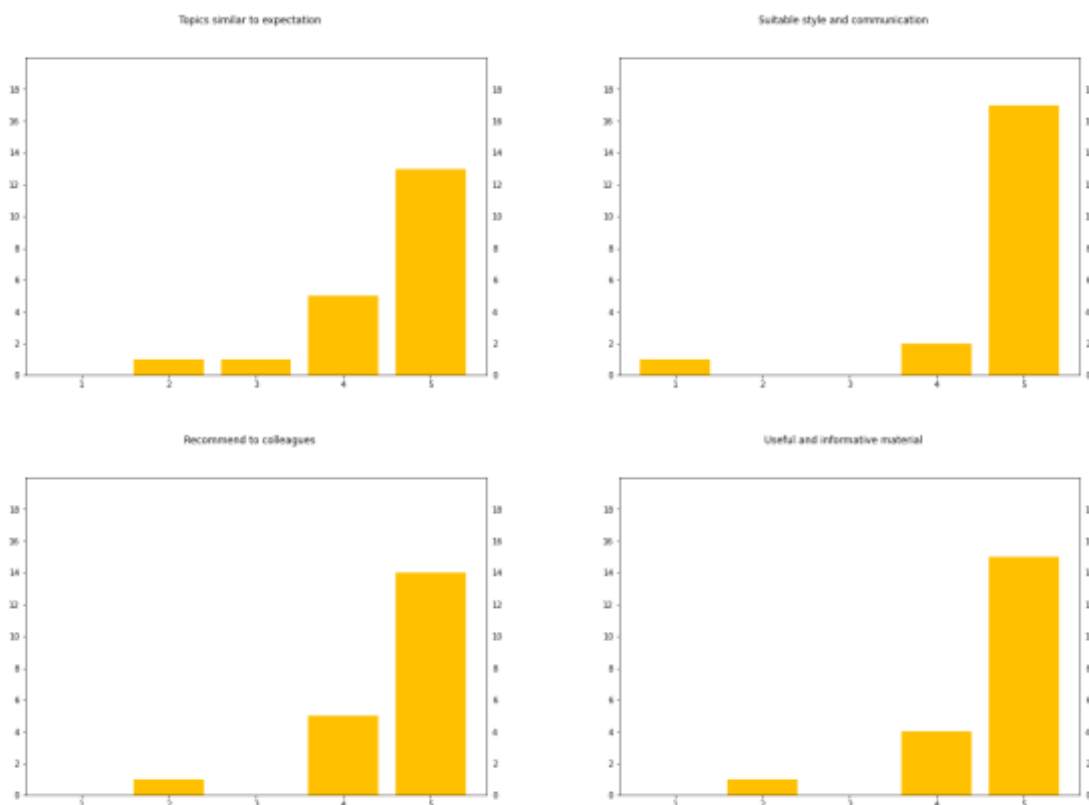


Figure 2: Participants level of agreement to statements

Event fulfilled participants expectations well. Participants felt that material was useful and informative, and style and communication suited well the nature of the event. Almost every participant that answered the evaluation form would recommend similar event to colleagues. Materials and style of the communication suited online format. Topics were largely what participants were expecting showing that student had some prior knowledge in conceptual modelling.

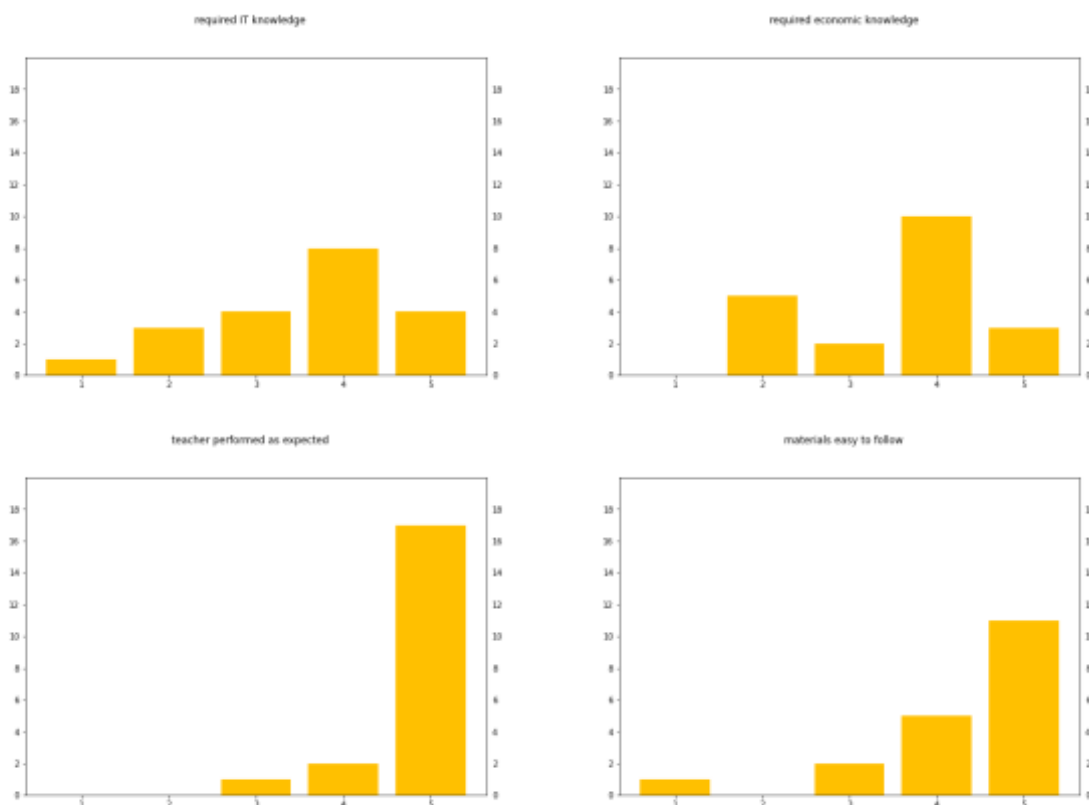


Figure 3: Answers to Yes-No questions

According to participants topics in NEMO Day 2021 required moderate to high prior IT-knowledge. Similarly prior economic knowledge was also required to fully understand the lectured. Lecturers' performance was rated high even though materials were not rated as easy to follow as teachers performance. Student backgrounds were diverse but still most of the students felt that material was easy to follow. Regardless of the requirement for moderate knowledge in IT and economics materials were relatively easy to follow demonstrating that presentations were well aimed for the target audience.

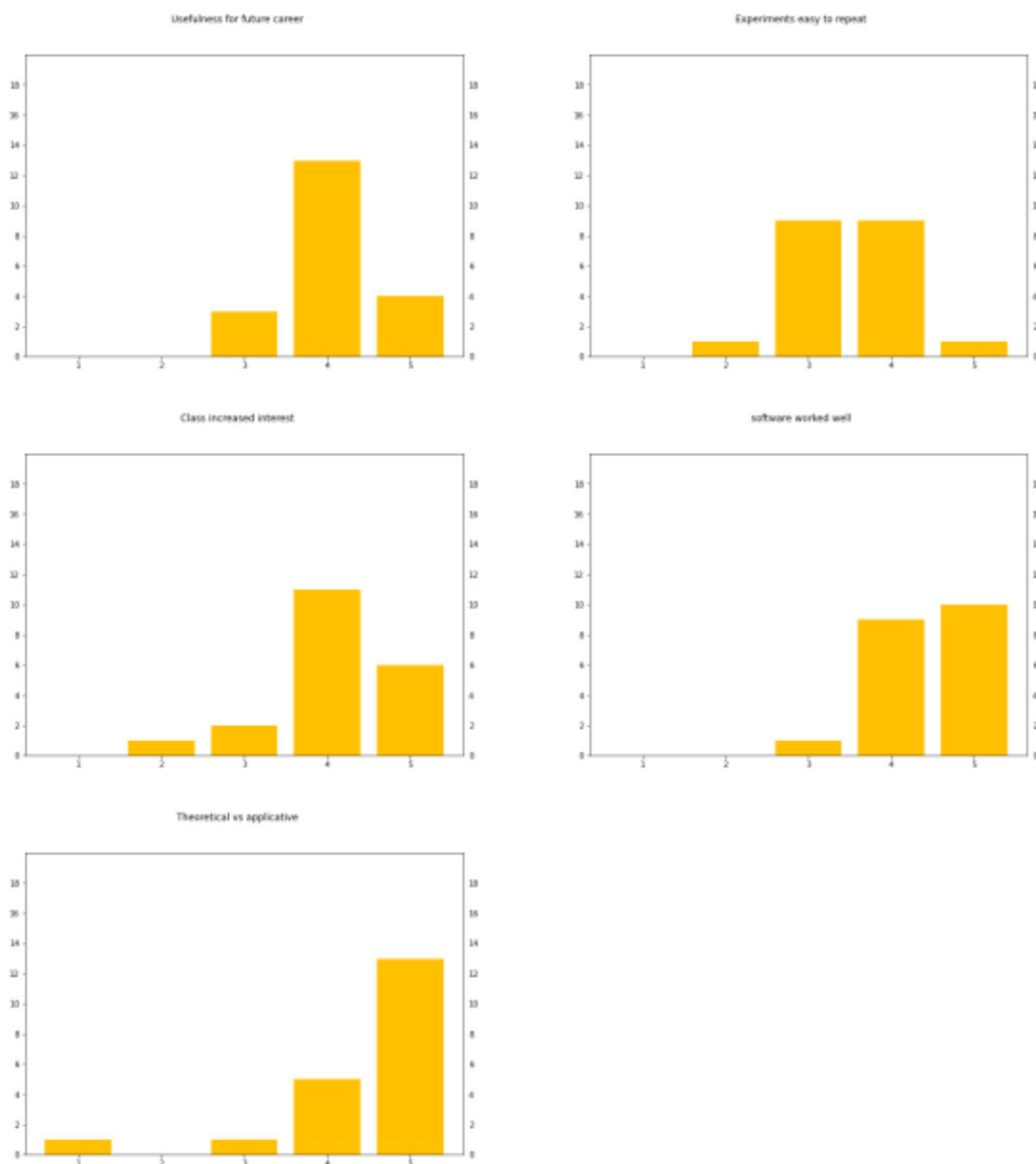


Figure 4: Answers to miscellaneous questions

Participants felt that event will be useful in their future career and only one student felt that event lessened their interest in the topics presented. Students believe that they could repeat experiments demonstrated with only moderate effort. Software worked fairly well during demonstrations with only minor problems. Students appreciated applicative parts of presentations over theoretical parts.

3.2 Open questions



Figure 5: Word cloud of the main improvement points

Main improvements for the seminar were that seminar was too theoretical and had too little practical aspects. Another point raised was with problem statement. It was not clear to every participant what presented tools were for.



Figure 6: Word cloud of the main strengths of the seminar

Participants found presenters to be engaging and passionate. Topics were interesting and novel for the participants. Time management and conference leading was friendly but efficient.



Figure 7: Word cloud of the main advantages and disadvantage of the online format

Seminar was organized as an online event and participants were asked the main advantages and disadvantages of online events. Main advantages are the ease of access to seminar and the fact that presenters and attendees come from diverse backgrounds and locations. The main disadvantages were the more difficult or unnatural interaction between lecturer and students. Also, the lack of physical access makes demonstrations less engaging.

3.3 Presenter's feedback

Feedback revived from the presenters is presented below:

The course was well-organized. I had some minor technical problems because of the digital platform. The short duration of the overall session is a positive point to enhance attractiveness.

Because of such short communications, the orientation is on sharing innovative ideas and initiatives, to open a larger international awareness on such emerging innovations. Somehow it is contributing to more open innovation within the OMILAB Community. This could be more highlighted when we spread the proposal for participation: more communication on 'The innovation corner'. The quite large international participation (10 countries) is a very good point and it emphasizes that the OMILAB community is already largely international.

Concerning the operational execution: 20min is a very short time period when you want to understand a minimum on a new innovative topic.

A solution with 30min time slots would be great, at least when there is a demonstration of tool.

Having an introductory slide underlying how the contents from various lectures are logically articulated one with regards to another could be great.

Interactions just after the talk were inactive: would it be possible to gather all interaction slots together after the lectures, to generate more interactions at this moment?

Professor Xavier Boucher

"Unfortunately, the sanitary conditions caused by the COVID-19 pandemic prevented the 2020 Next-Generation Enterprise Modelling (NEMO) summer school from taking place. This has caused disappointment among both students and teachers.

Through the NEMO Day event from 29.01.2021 we set out to initiate a series of online events to make up for the loss of the summer school of 2020 but also to test to what extent online teaching methods can replace physical teaching face to face, if there is interest from the students' part, how the courses are appreciated and understood, etc.

Judging by the large number of participants but especially by the number of questions at the end, I think the event has reached its goal. In addition, I was pleasantly surprised by the depth of the students' questions and especially by the new suggested research ideas that we will study, analysing them in our research groups.

One thing is for sure, NEMO Day should not remain a singular event but should continue, maybe even extending the target audience toward companies activating in the Manufacturing sector but not only!

Professor Adrian Florea, Technical Coordinator of DigiFoF project"

Presenters felt that event was well organized and successful. There were minor technical issues with one presentation but otherwise there were no problems. Number and internationality of participants was quite large for a quickly organized event. After some individual presentations, the interaction was low, however in the Q&A session at the end of the event participants asked questions towards all presenters. In addition. the depth of the students' questions was pleasant surprise demonstrating that this kind of online event is not only useful for students but also can give new insight to presenters. The presenters pointed out that the allocated time of 20 minutes for the presentation was relatively short for introducing an innovative topic.

3.4 Summary of the results

NEMO Day 2021 was a successful event and the number of participants was high. Feedback from the event was mainly positive and many of the attendees would recommend the event for their colleagues. Material presented was novel for several participants and raised their interest in the digital design skills for factories of the future. In future online events more practical aspects should be given attention. In case of the practical part with the ADOxx tools, the link to the respective tool could be distributed to the participants before the event, so they can follow the demonstration on their own machine. For demonstrating cyber-physical-systems pre-recorded video could be considered to minimize technical issues. There is need to improve interaction between students and teacher during the seminar.

4 NEMO Day - April 2021

After great success with NEMO Day 2021 the DigiFoF project decided to organize second and third NEMO Day on April 16th and May 14th. Partners from the DigiFoF project were invited to give presentations on those these events.

All details related to the event can be found online at:

https://www.omilab.org/activities/events/nemoday2021_april/

Presentations given during the NEMO Day 2021 April are presented in the table below:

Presentation	Presenter(s)
Introduction DigiFoF Project	Prof. Dr. Adrian Florea, Lucian Blaga University of Sibiu, Romania
Digital Design Thinking	Dr. Wilfrid Utz, OMILAB NPO, Berlin, Germany
Autonomous vehicle fleet management	BEng, PhD Arkadiusz Jurczuk , Bialystok University of Technology, Poland and Zbigniew Misiak , BOC Poland

The number of registered participants was 46 from 9 different countries and 13 organisations. After the event participants were asked to fill a questionnaire to evaluate the event. The number of responses got from the questionnaire was 23. The questionnaire was divided in five parts:

1. Satisfaction in various aspects
2. Agreement to statements
3. Yes/no questions
4. Miscellaneous multiple-choice question
5. Open questions

The questions presented in the evaluation form are presented in appendix I. Results from multiple choice questions are presented below. At this event was awarded 40 badges.

4.1 Participant feedback

In next charts the x axes represent the satisfaction degree with values from 1 (not satisfied) to 5 (very satisfied).

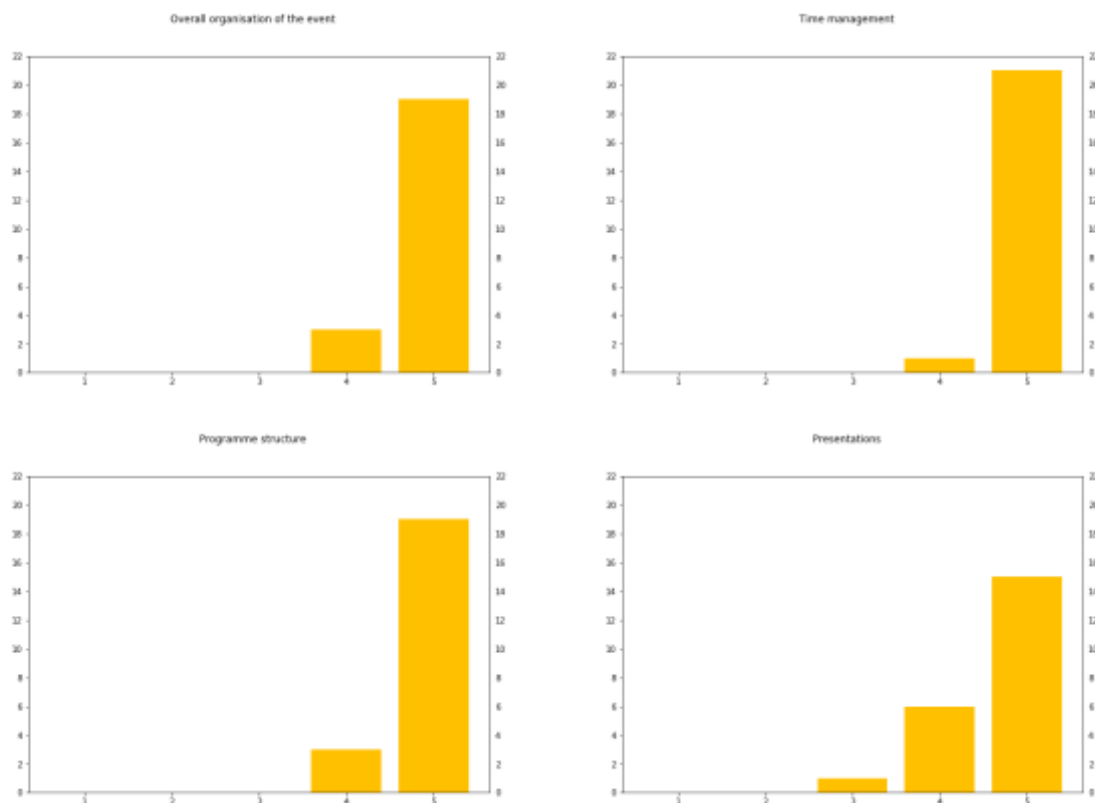


Figure 8: The overall satisfaction in the event

Participants were highly satisfied with the organisation of the event. In every aspect the event gained mostly the highest score. Overall event was again very successful.

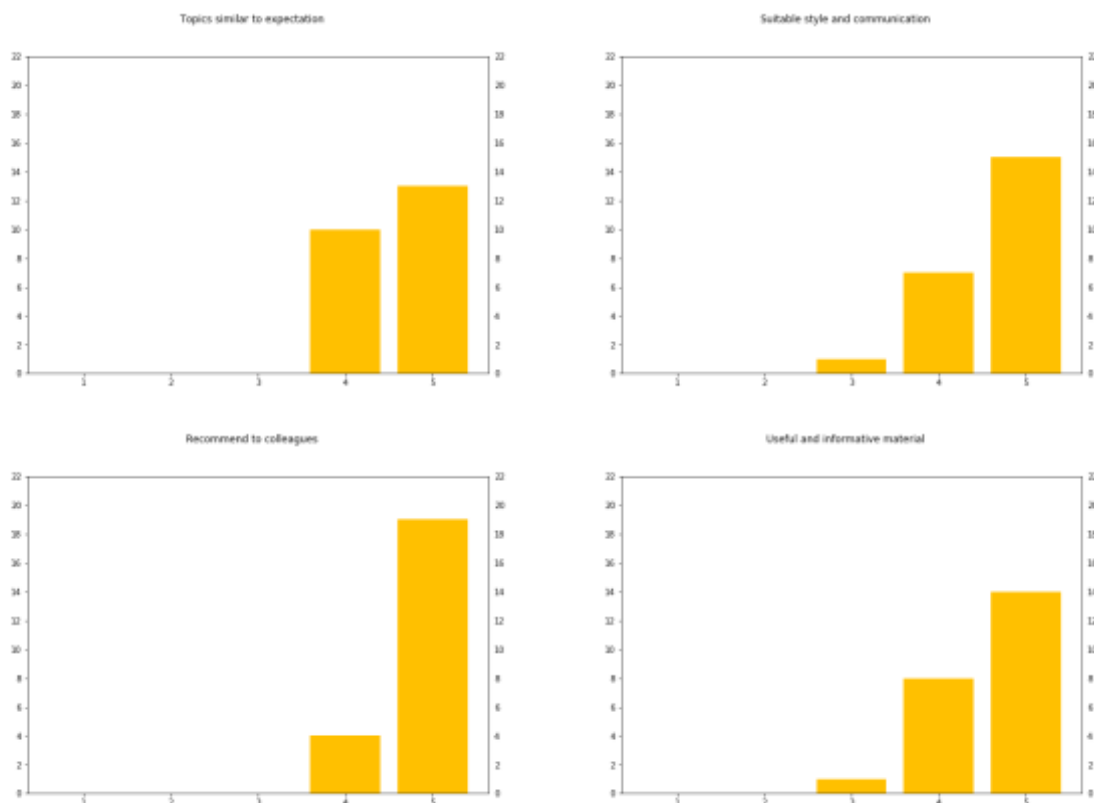


Figure 9: Participants level of agreement to statements

The event fulfilled participants expectations well. Participants felt that material was useful and informative, and style and communication suited well the nature of the event. Almost every participant that answered the evaluation form would recommend similar event to colleagues. Materials and style of the communication suited the online format. Topics were largely what participants were expecting, showing that the students had some prior knowledge in conceptual modelling.

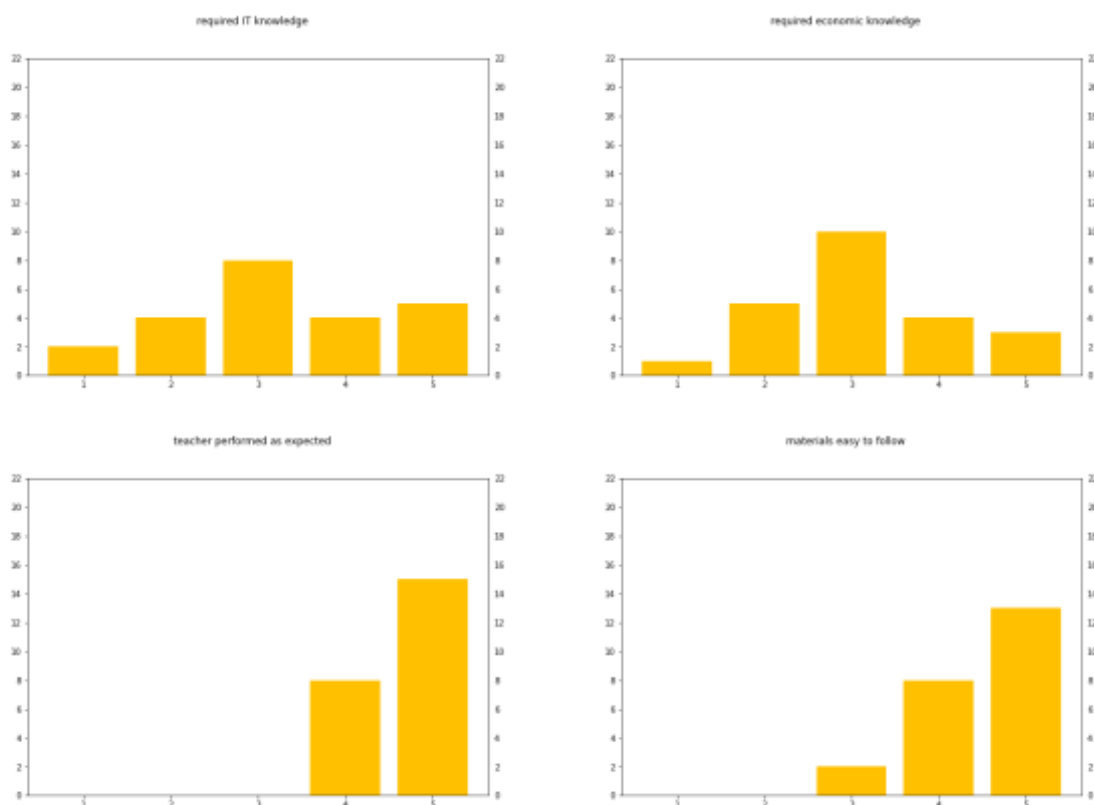


Figure 10: Answers to Yes-No questions

According to participants at NEMO day 2021 April are required moderate to high prior IT-knowledge. The results show that prior knowledge in business management was also required to fully understand the lecture. Lecturers' performance was rated high even though materials were easy to follow as teacher's performance. Student backgrounds were diverse but still most of the students felt that material was easy to follow. Regardless of the requirement for moderate knowledge in IT and economics materials were relatively easy to follow demonstrating that presentations were well aimed for the target audience.

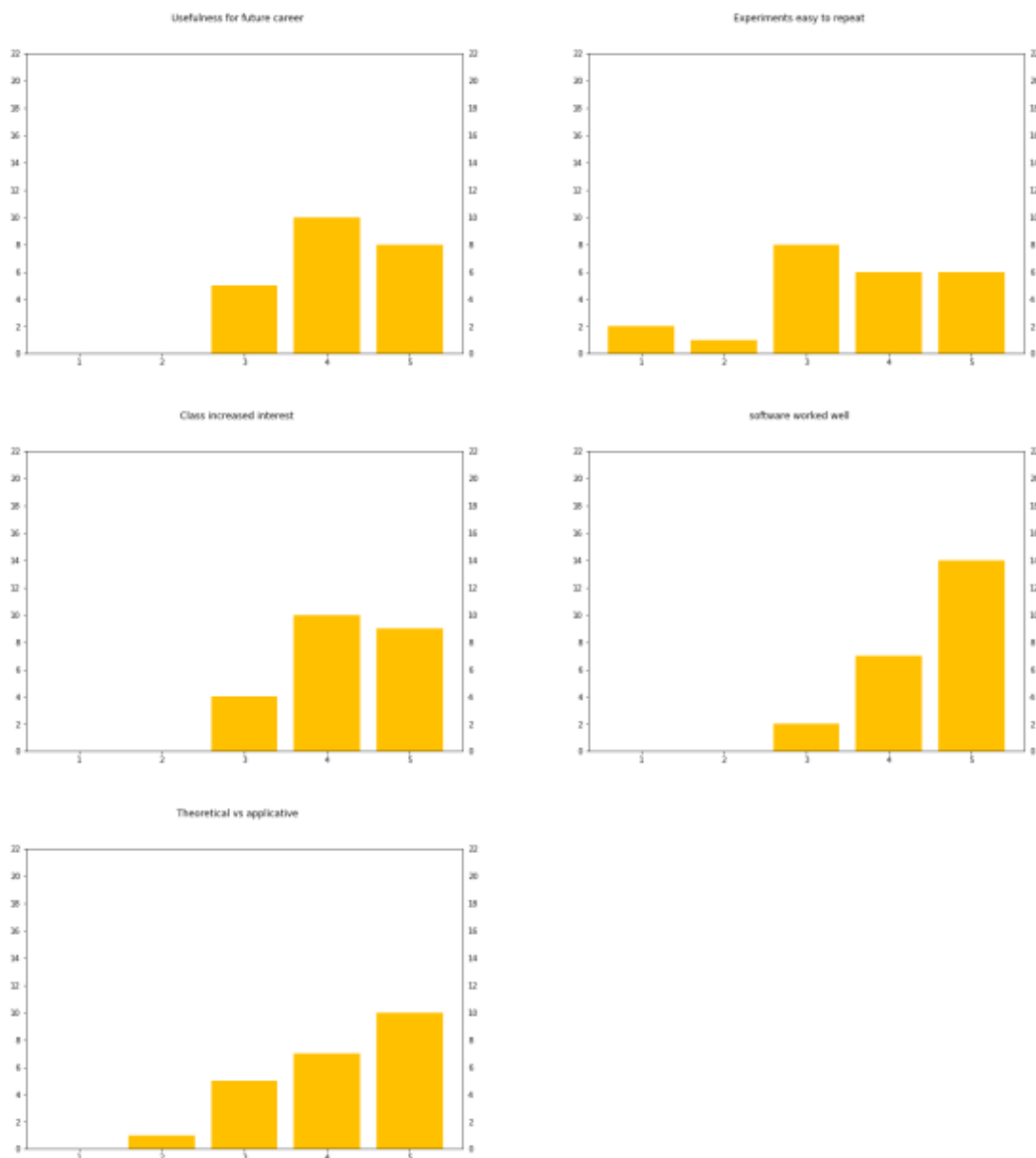


Figure 11: Answers to miscellaneous questions

Participants felt that the event will be useful in their future career and the interest in the presented topics generally increased after attending the event. Students believe that they could repeat experiments demonstrated with only moderate effort. Software worked fairly well during demonstrations. Students appreciated applicative parts of presentations over theoretical parts.



Figure 14: Word cloud of the main advantages and disadvantage of the online format

Seminar was organized as an online event and participants were asked the main advantages and disadvantages of online events. The main advantages are the ease of access to seminar and the fact that presenters and attendees come from diverse backgrounds and locations. The main disadvantages were the more difficult or unnatural interaction between lecturer and students. Also, the lack of physical access makes demonstrations less engaging. With online events there can be *technical issues from unreliable internet connection*.

4.3 Summary of the results

NEMO Day April 2021 was a successful event and number of participants was high. Feedback from the event was mainly positive and many of the attendees would recommend the event for their colleagues. Similar to January, event participants would hope more practical parts for the seminar. There is still a need to improve interaction between students and teacher during the seminar.

5 NEMO Day - May 2021

After great success with NEMO Day 2021 in April the DigiFoF partners from project decided to organize second and third NEMO Day

All details related to the event can be found online at:

https://www.omilab.org/activities/events/nemoday2021_may/

Presentations given during the NEMO Day 2021 May are presented in the table below:

Presentation	Presenter(s)
Introduction DigiFoF Project	Prof. Dr. Adrian Florea, Lucian Blaga University of Sibiu, Romania
Ontology-aided Enterprise Modelling for Human and Machine Interpretation	Prof. Dr. Knut Hinkelmann , OMiLAB NPO, Germany/University of Applied Sciences and Arts Northwestern, Switzerland
Design and engineering of product service solutions	Dr. Fabiana Pirola, University of Bergamo, Italy
Automation of assembly lines assisted by a robotic arm and a mobile robot	Octavian-Isaia Baltes, Lucian Blaga University of Sibiu, Romania
Collaborative robotics in action	Prof. Dr. Juha Rönning, University of Oulu, Finland

The number of registered participants was 56 from 9 different countries and 11 institutions. After the event participants were asked to fill a questionnaire to evaluate the event. Response for the questionnaire was received from 11 participants The questionnaire was divided in five parts:

- 1 Satisfaction in various aspects
- 2 Agreement to statements
- 3 Yes/no questions
- 4 Miscellaneous multiple-choice question
- 5 Open questions

The questions presented in the evaluation form are presented in appendix I. Results from multiple choice questions are presented below. At this event we have only 11 respondents at the questioner and but was awarded 52 participants with badges.

5.1 Participant feedback

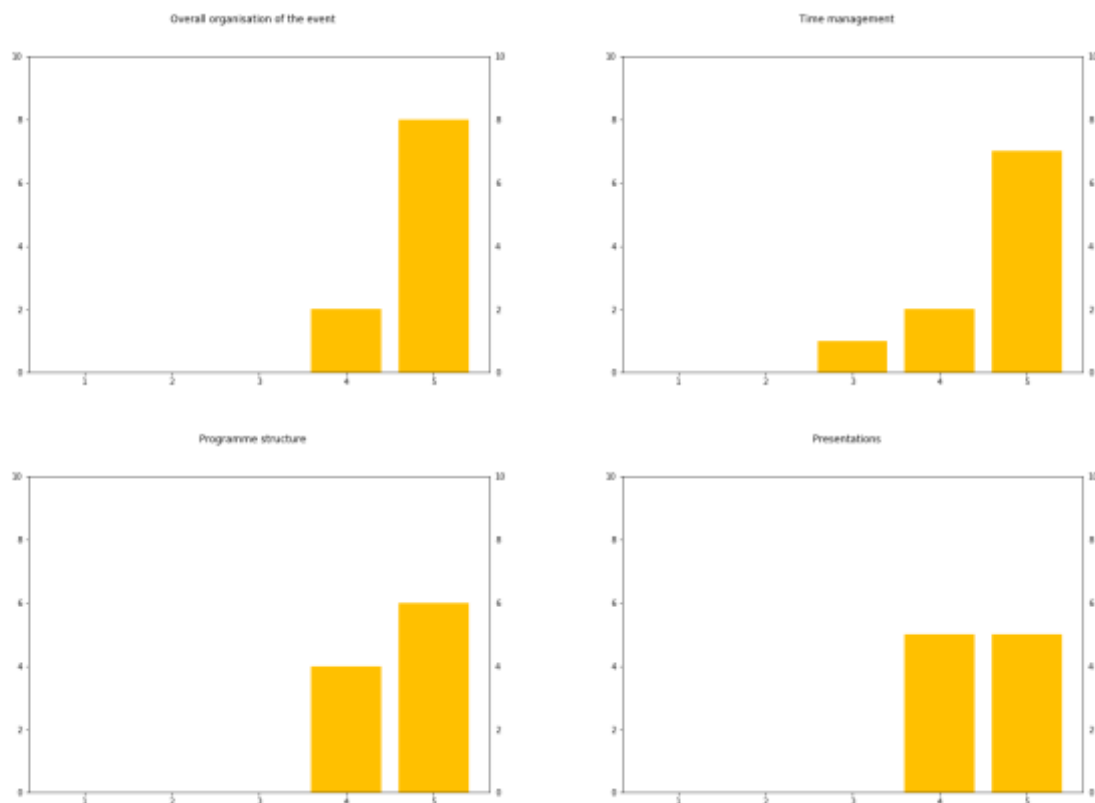


Figure 15: The overall satisfaction in the event

Participants were highly satisfied ~~in~~ with the organisation of the event. In every aspect, the event gained mostly the highest score. Overall, the event was again very successful.

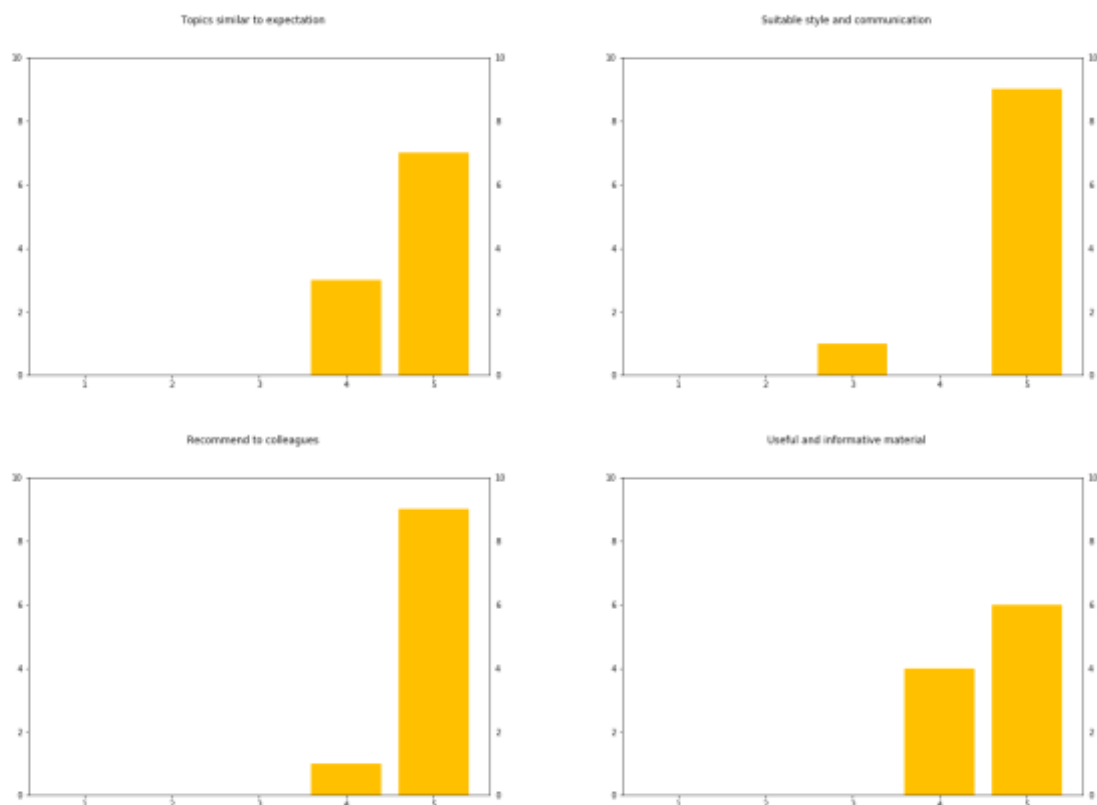


Figure 16: Participants level of agreement to statements

Event fulfilled participants expectations well. Participants felt that the material was useful and informative, and style and communication suited well the nature of the event. At as the first NEMO DAY almost every participant that answered at the evaluation form would recommend similar event to colleagues. Materials and style of the communication suited online format. Topics were largely what participants were expecting.

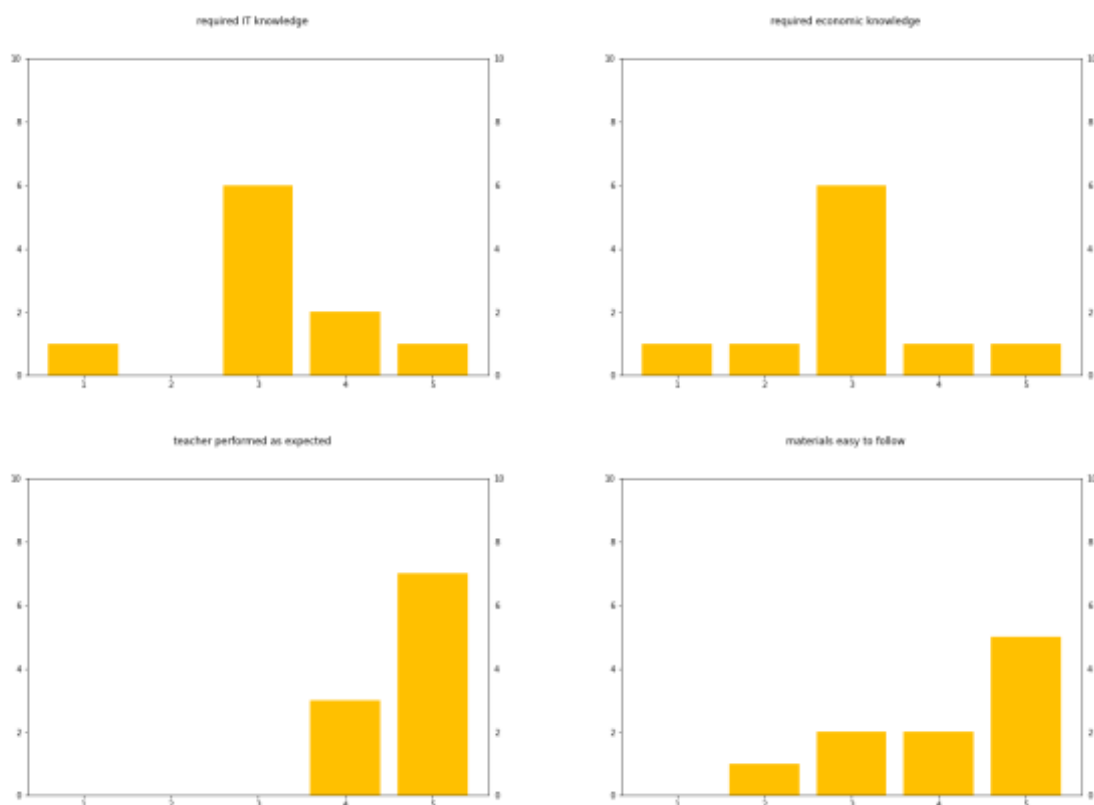


Figure 17: Answers to Yes-No questions

According to participants responses, the topics in NEMO Day May required moderate to high prior IT-knowledge and some economic knowledge. Lecturers' performance was rated high even though materials were not rated as easy to follow as teacher's performance. Student backgrounds were diverse but still most of the students felt that material was easy to follow. Regardless of the requirement for moderate knowledge in IT and economics materials were relatively easy to follow demonstrating that presentations were well aimed for the target audience.

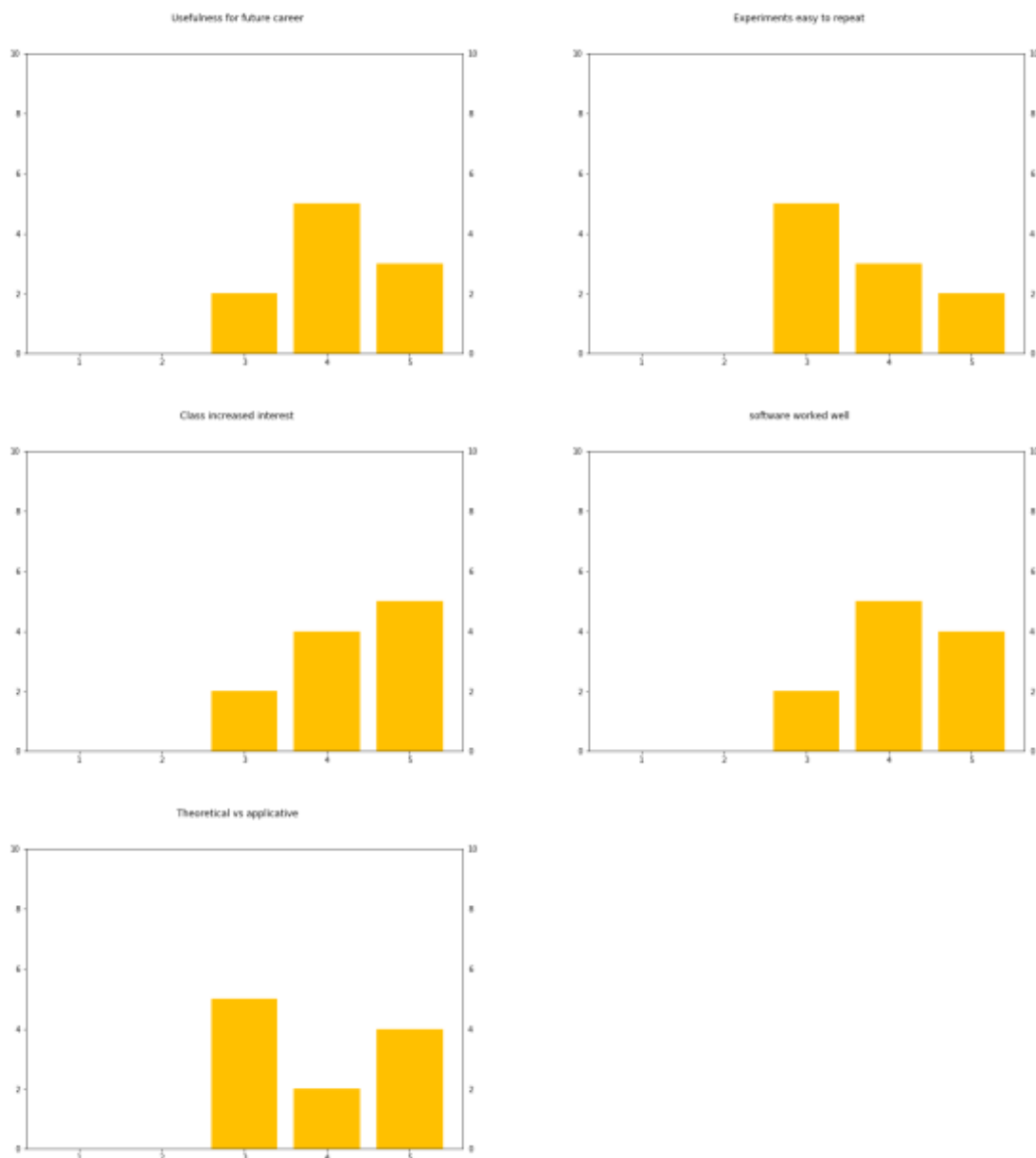


Figure 18: Answers to miscellaneous questions

In their responses the participants felt that event will be useful in their future career and interest in presented topics generally increased. Students believe that they could repeat, with a moderate effort, the experiments. Software worked well during demonstrations. Students appreciated well the applicative parts of presentations over theoretical parts.



Figure 21: Word cloud of the main advantages and disadvantage of the online format.

Seminar was organized as an online event and participants were asked the main advantages and disadvantages of online events. Main advantages are the ease of access to seminar and the fact that presenters and attendees come from diverse backgrounds and locations. Recording of the seminar that was made available for later viewing was seen as positive. The main disadvantages were the more difficult or unnatural interaction between lecturer and students. Also, the lack of physical access makes demonstrations less engaging.

5.3 Summary of the results

NEMO Day May 2021 was a successful event and number participants was high. Feedback from the event was mainly positive and many of the attendees would recommend event for their colleagues. Similar to January and April event participants would hope more practical parts for the seminar. There is still a need to improve interaction between students and teacher during the seminar.

6 NEMO Summer school 2021

All details related to the event can be found online at: <http://NEMO.omilab.org/2021>

The NEMO summers school was organized by OMiLAB NPO as online event between 19.07 and 30.07.2021. There were 252 registered participants from 48 countries and 123 institutions.

Presentations given by DigiFoF partners during the NEMO Summer school are presented below:

Presentation	Presenter(s)
The industrial transition towards Product-Service-Systems: articulating enterprise modelling and economic model balancing	Prof. Dr. Xavier Boucher, Mines de Saint-Etienne University, France
Service Engineering models for the design and development of Digitalised Product-Service Systems	Prof. Dr. Sergio Cavalieri Assoc. Prof. Giuditta Pezzotta, University of Bergamo, Italy

After the above-mentioned presentations, the participants were asked to fill in a questionnaire to evaluate them. Questionnaire was divided in three parts:

- 1 Multiple choice questions about lecture and materials
- 2 Miscellaneous multiple choice questions
- 3 Open Questions

The questions presented in the evaluation form are presented in appendix I. Results from multiple choice questions are presented below.

6.1 The industrial transition towards Product-Service-Systems: articulating enterprise modelling and economic model balancing

6.1.1 Participant feedback

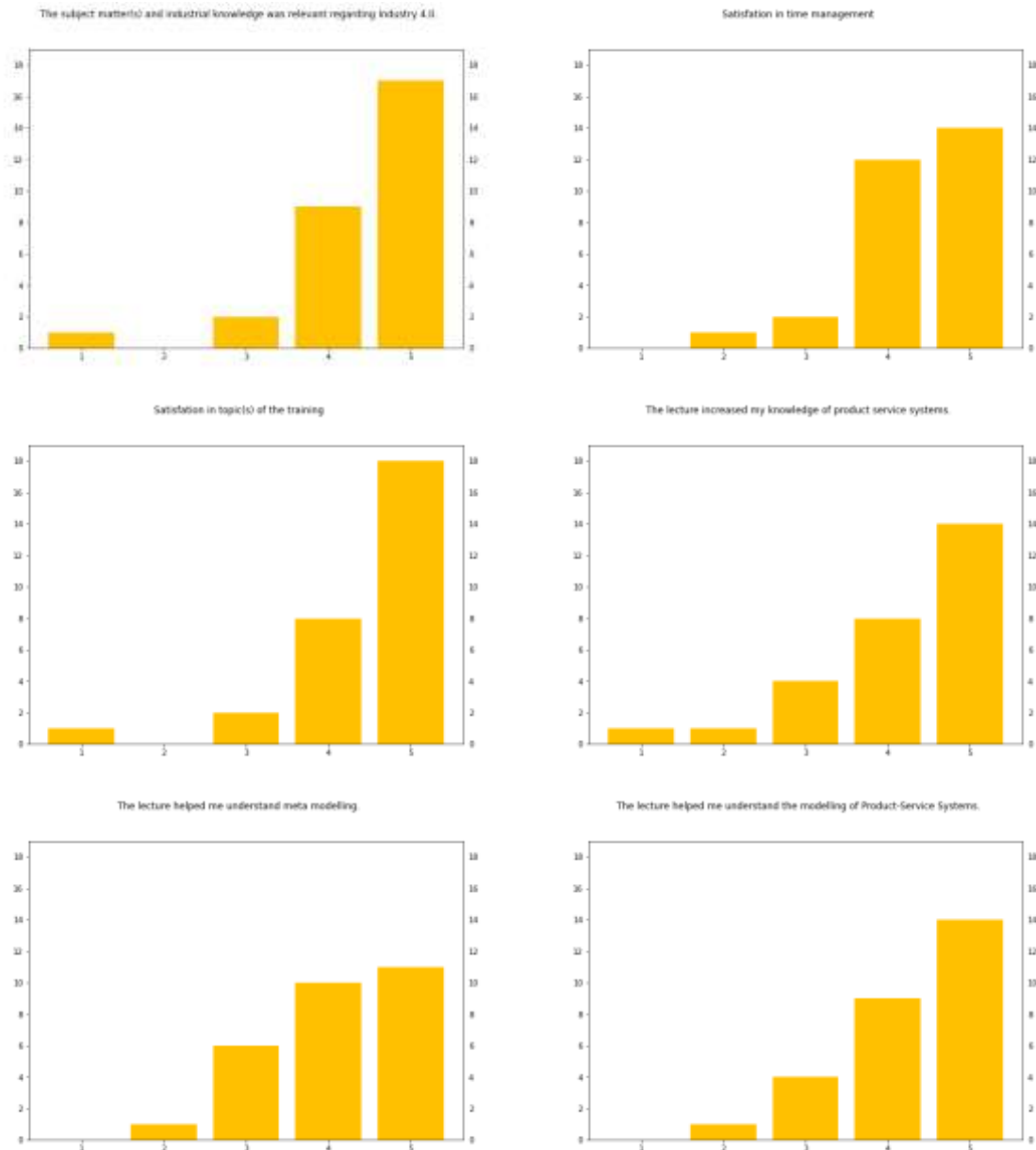


Figure 22: Feedback about lecture and materials

Participants were generally satisfied with the lecture and the lecture helped participants to understand modelling and product-service systems. Students felt that there wasn't enough time for the lecture, but the lecturer used that time well.

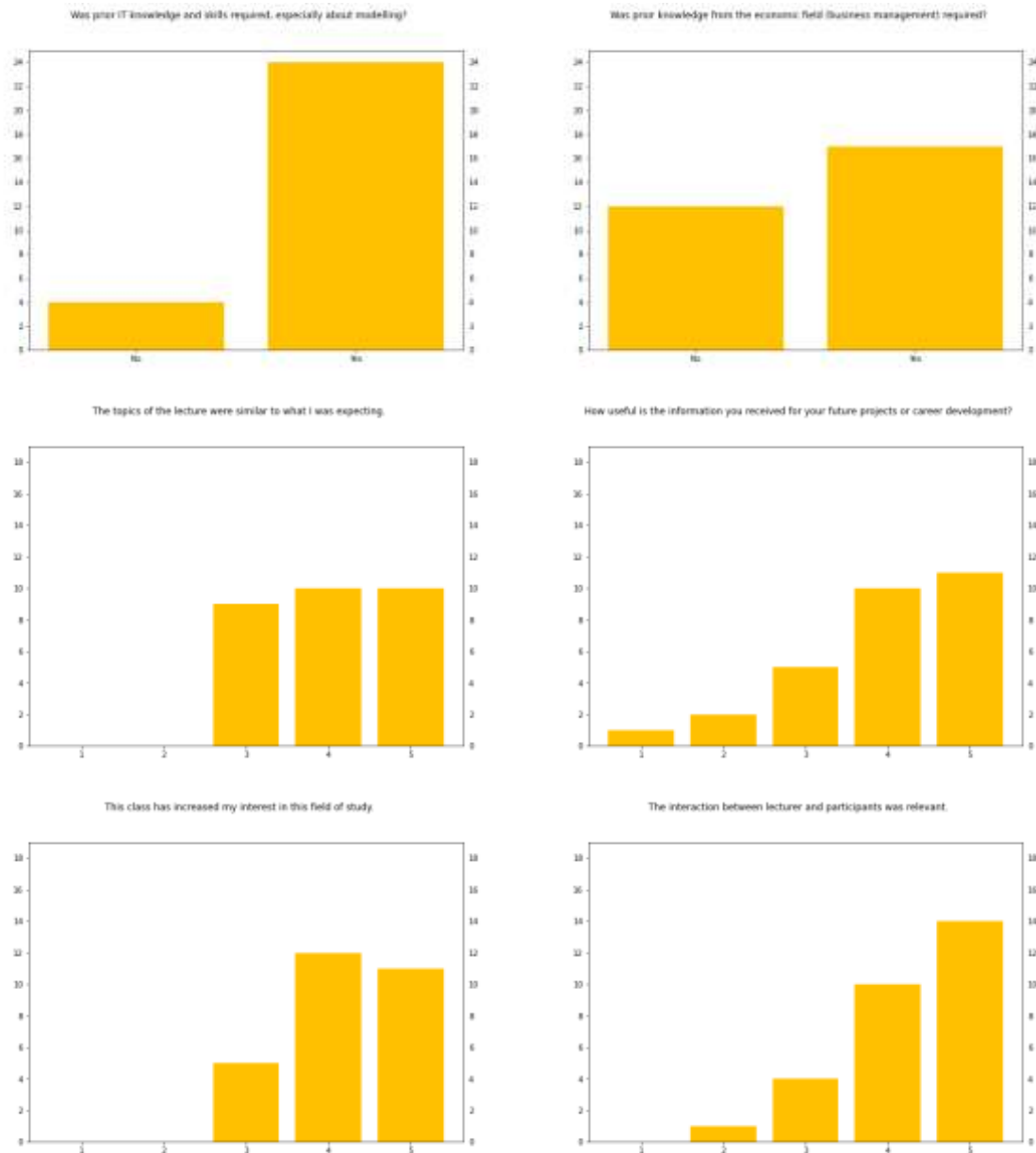


Figure 23: Miscellaneous questions

Most of the students felt that there was need for prior IT-knowledge to fully follow the lecture. Opinion about need for prior knowledge about economy was divided with one third feeling that it was not necessary and two thirds feeling that prior knowledge was necessary. Topic of the lecture was similar to what participants were expecting. Students felt that the lecture would be useful in their future projects and the lecture increased their interest in the topic. Students were pleased in the interaction between them and the lecturer.

6.1.2 Open questions

Full results from the open questions are presented in the appendix II

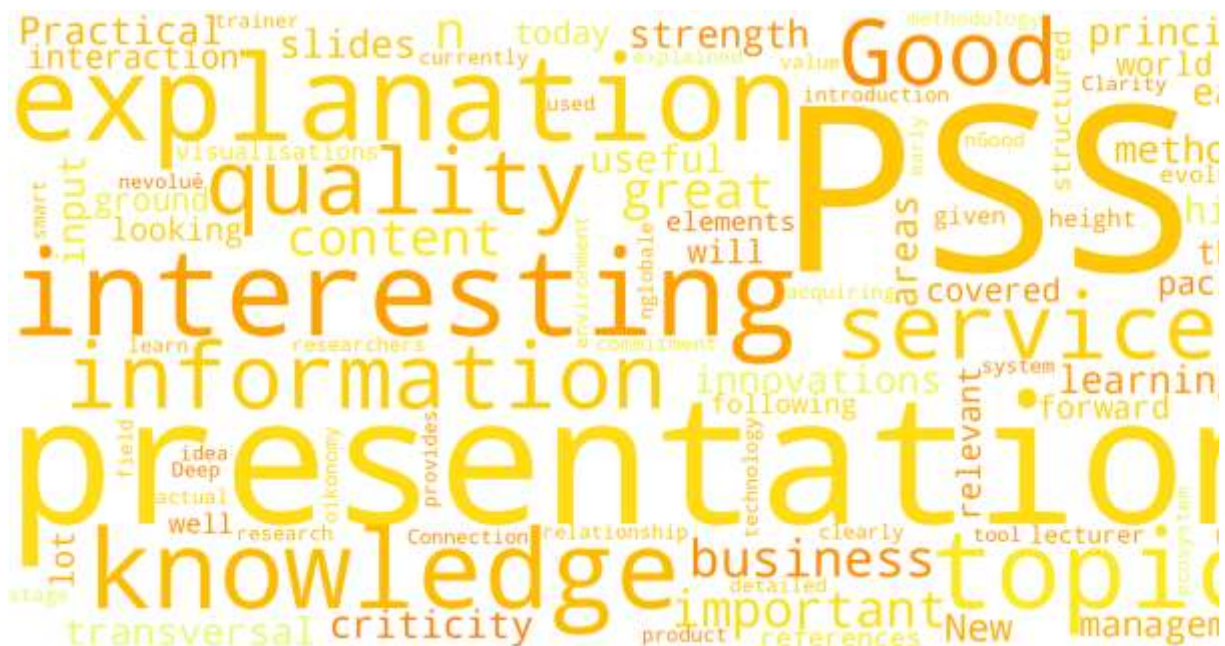


Figure 24: Word cloud of the seminar's main strengths

Main strengths of the lectures included clarity of explanation about PSS with some practical examples. Topic of the lecture was related to the conceptual modelling.



Figure 25: Comments about lecture and materials

Students enjoyed the lecture and the materials. Because of the complex topic and short time lecturer couldn't go too deep in the details. Slides were full of visualization and some of them felt overfull.

As with the NEMO-days main improvements for the lecture were additional time, more practical examples and student inclusion.

6.2 Service Engineering models for the design and development of Digitalised Product-Service Systems

6.2.1 Participant feedback

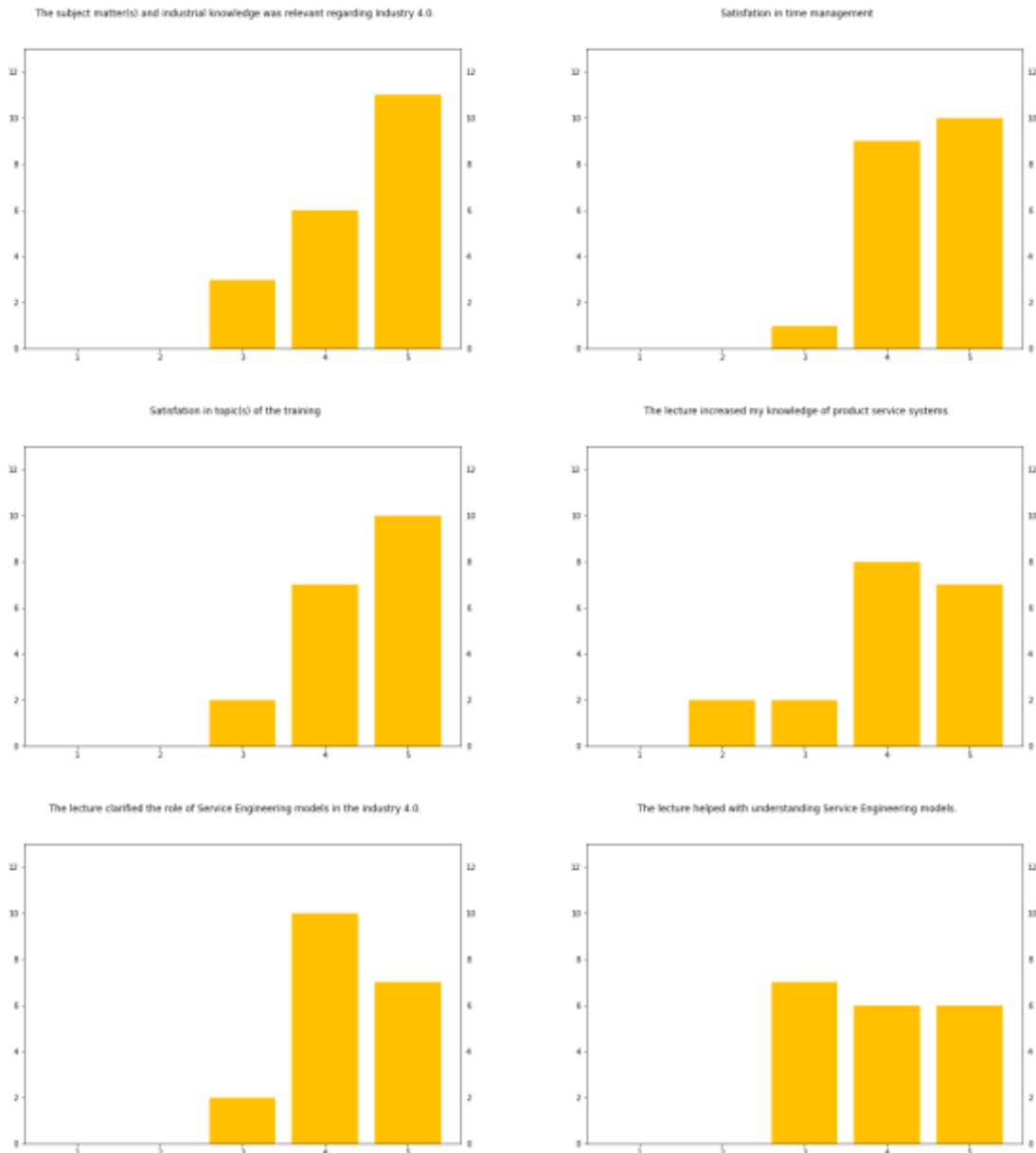


Figure 28: Feedback about lecture and materials

Participants were generally satisfied with the lecture and the lecture helped participants to understand modelling and product-service systems. Students felt that they understood the

role of service engineering models in the industry 4.0 well, but for understanding the Service Engineering models, the lecture itself wasn't as helpful.

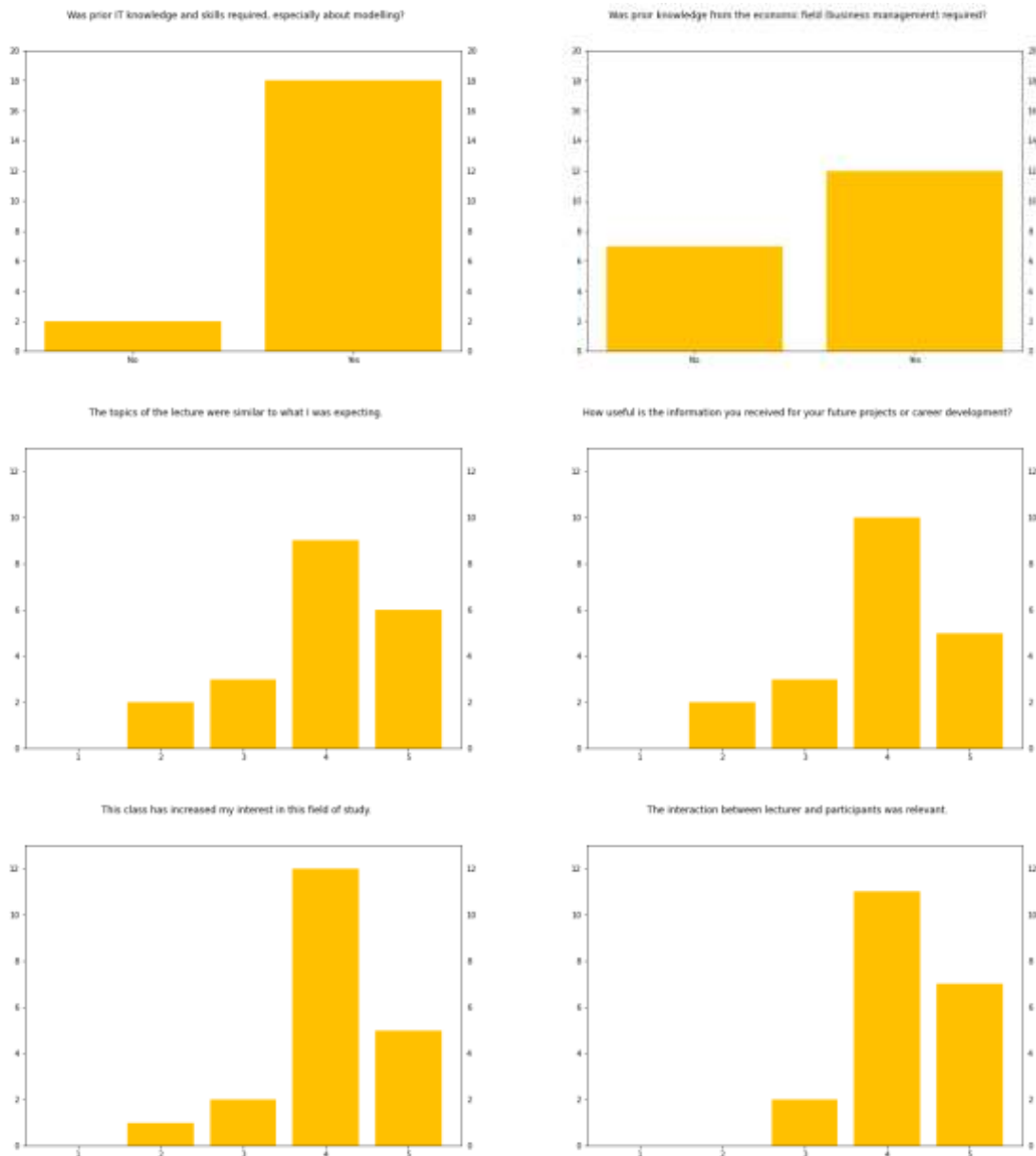


Figure 29: Miscellaneous questions

Most of the students felt that there was need for prior IT-knowledge to fully follow the lecture. Opinion about need for prior knowledge about economy was divided with one third feeling that it was not necessary and two thirds feeling that prior knowledge was necessary. Topic of the lecture was similar to what participants were expecting. For few students the topic did not match the expectations. Students felt that the lecture would be useful in their future projects and that the lecture increased their interest in the topic. Students were pleased in the interaction between them and the lecturer.

7 Local NEMO Day 2021 (for students of Bialystok University of Technology, Faculty of Engineering Management, UNIBIAL)

Following to positive response to NEMO online events, Politechnika Białostocka, together with BOC, decided to test this novel approach as a local event organised for selected group of students of Bialystok University of Technology, Faculty of Engineering Management. The aim of this test was twofold:

- Testing local instance of NEMO laboratory (at UNIBIAL), know-how and teaching skills as well as maturity of training materials
- Provide basis for a long-term and sustainable, local cooperation of academy and industry

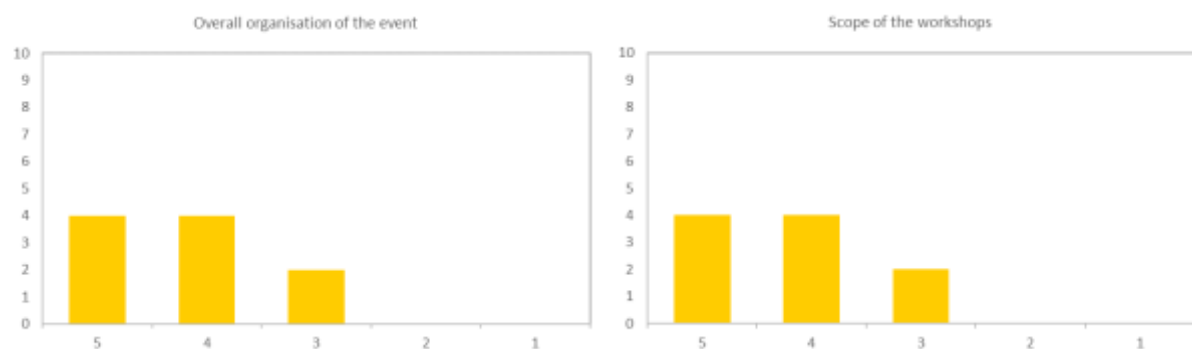
Local NEMO days were organised on 20th of October and 03rd of November 2021 as a hybrid event (virtual/stationary) with 17 registered participants (fields of study: management, management and service engineering).

Presentations given by DigiFoF partners are presented below:

Presentation	Presenter(s)
Process modelling with BPMN 2.0.	Zbigniew Misiak , BOC Poland
Process optimisation with BPMN 2.0 and knowledge-based engineering	BEng, PhD Arkadiusz Jurczuk , Bialystok University of Technology, Poland

7.1 Participant feedback

Participants were generally very satisfied with the workshops. They evaluated the organisation of workshops and their thematic scope relatively well. The vast majority of participants rated very highly the presentations on process modelling with BPMN 2.0 and process optimisation. The duration of the workshops was well chosen, however, the participants suggested extending the duration of the workshops and organising them cyclically.



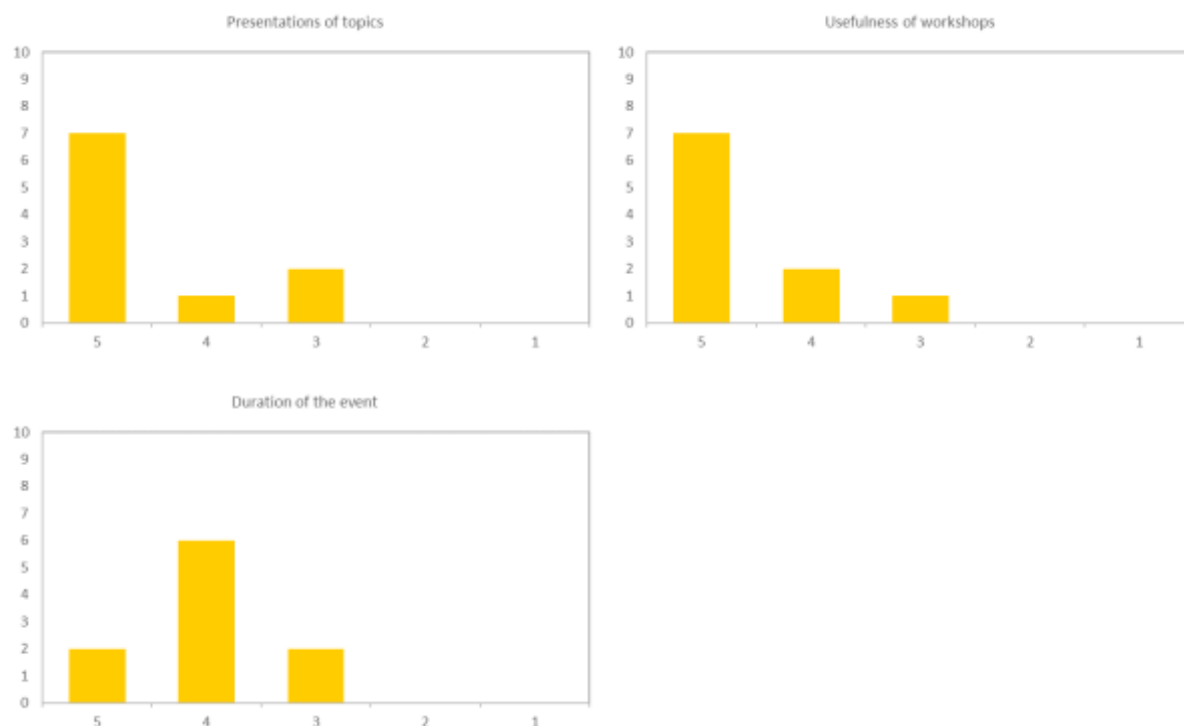


Figure 33: Feedback about workshop (Number of participants = 17, number of questionnaires = 10)

The comments and recommendations of the workshop participants were presented in the form of a word cloud (Figure 28).



Figure 34: Word cloud of the improvements

Participants indicate the need to extend the duration of the workshop. Moreover, they could take place periodically. Furthermore, the need for practical exercises within the workshop was suggested. The need to develop training in process modelling was indicated. For some students on-line training is a convenient form.

7.2 *Summary of results*

The workshop was organised for students of the Bialystok University of Technology (UNIBIAL) as part of the Nemo Summer School. They had the character of a local event and were addressed to students of the Faculty of Management Engineering. Feedback from the UNIBIAL students was mainly positive indicating that workshops were well prepared and useful. The collected comments and recommendations from the students underlined the need to continue the workshops and to include practical activities for students on process modelling with BPMN 2.0 and process optimisation.

8 Conclusions

8.1 *NEMO Days 2021*

The cancellation of NEMO 2020 Summer School affected the DigiFoF project. Originally, the plan was to evaluate the developed academic materials during the Summer School, but the situation with COVID-19 made that plan infeasible. For this reason the NEMO Day 2021 event series was organized, partly to replace NEMO 2020 Summer School but also to test waters with online event and to see if online seminars would be suitable for teaching concepts of the Factory of the Future.

The three NEMO Day 2021 events clearly demonstrated that there is a demand for online seminars. However during such short events it is not possible to go into depth of the topic, so presentations will usually introduce innovative ideas and initiatives. Raising awareness of the design tools for the Factory of the Future helps more students to become interested in the DigiFoF concept. Such short seminars cannot fully compensate for the cancellation of the NEMO Summer School 2020 but can be used to increase awareness of the concepts of the DigiFoF.

8.2 *NEMO Summer School 2021*

NEMO 2021 Summer School was organized as online event due to the COVID-19 restrictions. Overall lectures given by DigiFoF partners were successful and received mainly positive feedback. Students felt that they understood aspects of industry 4.0 and Product-Service-Systems that were topics of these lectures. There was more time for the lectures and so more time for practical examples and going deeper in the topics. Still there was some feedback about lack of time and practicality. There was still room for improvement for the interaction between lecturer and students in the first lecture, but students were more satisfied in the interaction during second lecture. As an online event the participants could have been given access to the lecture and supporting material beforehand for easier lecture following. In regards to these two presentations, lack of practical exercises and workshops was seen as a downside of the online format.

NEMO Summer School demonstrated high interest in the conceptual modelling methods. There were over 200 registered participants from 48 countries. High participant count and internationality was likely due to the online format. With longer time allocated for each topic, lecturers could go deeper in the topics and present more examples to help with the understanding of the content. Participants felt that they learned something and generally their interest in presented topics increased, so lecturers were successful in teaching DigiFoF concepts.

APPENDIX A: Evaluation Questionnaire for NEMO Day 2021

How satisfied are you with the following aspects of the event?

(1: Not satisfied - 5: Very satisfied)

- Overall organisation of the event
- Programme structure
- Time management
- Presentations

Please indicate your agreement with the following statements

(1: Strongly disagree - 5: Strongly agree)

- The topics of the event are what I was expecting.
- The distributed material is useful and informative.
- The style and communication of the organisers is suitable for this kind of event.
- I would recommend this kind of event to my colleagues.

Please choose the most fitting option for the following questions.

(1: No - 5: Yes)

- Were prior IT (especially modelling) knowledge and skills required?
- Was prior knowledge from the economic field (business management) required?
- Has the teacher performed as you expected?
- Were the case materials easy to follow?

- How useful is the information you received for your future projects or career development? (1: Not useful - 5: Extremely important)
- How easy would it be for you to repeat the experiments on your own at your university?(1: Very hard - 5: Very easy)
- Which part of seminar did you appreciate most: the theoretical or the applicative part? (1: Theoretical - 5: Applicative)
- This class has increased my interest in this field of study. (1: Disagree - 5: Agree)
- Did the hardware / software applications work well during the practical experiments? (1: Didn't work - 5: No problems)

Open questions

- What specific things about the seminar could be improved to better support student learning? (limit to 3)
- What are the strengths of this seminar?
- This seminar is developed in an online manner. What do you think are the most important benefits and disadvantages of such a development?
- What is your background? What specific domain are you studying? (e.g. Engineering, Economics, Computer Science, etc.) (Optional)

ANNEX B: Answers to open questions

NEMO DAY April

What specific things about the seminar could be improved to better support student learning? (limit to 3):

Quizzes at the end of presentations.

The ADOxx platform and its modules

sometimes not so easy to follow because it was quite theoretic; not everybody has the same background knowledge; not so easy to ask good questions in a certain amount of time because time is need to think about everything first;

Everything was great

Nothing to improve from my side.

The seminar was very informative and the speakers were engaging but the meet application didn't have a (visible/intuitive) way of seeing the speaker presentations in full screen, so there were times when it was difficult to read the slides.

From my point of view we had a both practical experimental and theoretical explanations, so it had every thing that needed in order to support student learning.

It was quiet good, but it could be even better if it would be a little bit more interactive.

-maybe try to show something practical, not only theory
more accurate examples

-

- providing The tools in advance or a virtual machine to be download for running on own computers

Earlier notification of the appointment from the teacher

* I think only to improve the problem description - why it is a need for this (even though I understood the concept, I think I missed that part) * Anything else where really helpful and interesting in my point of view

The presentation to be more based on the application developed. The applications to be the center of the presentation and the starting point.

- motivate more students to take part! - Everything was fine, thank you very much!

Providing more exemples

- motivate more students to take part! - Everything else was fine, thank you very much!

Video materials could be helpful.

the number of presentations can be more to support different topics.

What are the strengths of this seminar?

It brings a new area in the field of study, that has not been approached during college. At least that is in my case.

Clear explanations from participants The interesting topic about PSS presented by Pr. Boucher

you can follow from anywhere; I like online presentations when lecturers convey their ideas so that students gain understanding;

Focus to what matters related to the topic

The participants discover a lot of new and interesting things.

The organization was efficient and the speakers were engaging and passionate about their respective fields of interest. We were presented with a clear understanding of the goals of the Factories of the Future project, and the presented material was suitable for reaching those goals.

Some of the strengths of this seminar might be that you get to see today how the design of tomorrow will be in the production processes, which can give students an advantage .

The skills and the enthusiasm of the teachers.

-The teachers which present and have knowledge to answer the question when is needed - Most presented topics are related to future improvement

good information provided

The ability to see some of the most recent projects developed in the conceptual modelling field. The ability to interact with field experts and see their creations in action.

- develop skills even in pandemic period - The seriousness of The participants

Different projects

* good presentations with examples and demos * very good explanation of the DigiFoF concept

The applicative part was a interesting experience and that made the presentation very interesting.

- innovative ideas - discussion - clustering of new ideas - information on what is currently happening in this area - motivating for students

time management and Leading the conférence friendly

- innovative ideas - discussion - clustering of new ideas - information on what is currently happening in this area - motivating for students

Subjects were interesting and are actual worldwide.

Presenting conceptual and petrinet which I was not familiar previously.

This seminar is developed in an online manner. What do you think are the most important benefits and disadvantages of such a development?

The biggest benefit is that everyone can join remotely regarding that people all around the world attend these seminars. The disadvantage is that if you have a bad connection you won't understand anything from the seminar.

I think that interactions are easier.

benefits: allows participation of people from all over the world; interesting insights from other universities; disadvantages: quality of presentation suffers if presenters are not familiar with this kind of online presentation (handling of moderator role)

benefits are ease of access, disadvantage is the lack of live interaction

Networking

Benefit: There are no cost of organizing/participating in this sessions. Disadvantages: The interaction between presenters and students will be more strong in person then in the online manner.

The main advantage of participating in the online seminar is that it facilitated bringing together participants from various backgrounds as well as different places. We might have otherwise not had the opportunity to participate. The downside to this, however, is that it is not the same as interacting face-to-face.

The benefit might be that people from all over Europe can gather at the same time. A disadvantage might be that some people learn more from a "hands-on" perspective, and it might be a little hard for them to understand.

One good thing about it's that it's less time consuming in terms of organization but I would prefer to attend a face to face meeting.

The most important benefit is that everyone can take part in the meeting no matter where they are from the disadvantages might be the fact that being online, we can't socialize the same as we would socialize being physically there.

benefit is that is no needed to travel disadvantage is that you can't socialize person to person with people involved

Benefits: ease of access, more comfortable Disadvantages: Maybe a f2f interaction could provide a better link between the attendees and the presenters

The Disadvantages: - the lack of networking between participants - the difficulty to see and put the hand on simulation of some physical devices, CPS tools. The main advantage is that could freely participate a large number of people from all over the world

A discussion could be compromised because it feels different when discussing face2face and being able to ask spontaneous questions.

Benefits: we stay healthy Disadvantages: might be connection issues

A benefit it was that you are in the home's comfort and you could assimilate the information very well. But also this is still a big disadvantage because you could easily lose the narrative thread.

benefits: - accessible at anytime from anywhere disadvantages: - technical problems may occur - online discussions are ok, but cannot fully replace discussions in physical presence (that's not the same).

no disadvantage

benefits: - accessible at anytime from anywhere disadvantages: - technical problems may occur - online discussions are ok, but cannot fully replace discussions in physical presence (that's not the same).

The benefits are that it is easily to take part of it. Home, office or where you are you just have to sign in. As disadvantage i would say that the interaction may not have been exactly what the teachers wanted (camera off, they didn't see our reactions for example)

disadvantage is loosing the internet connection during the seminar and benefit is saving money.

NEMO DAY April

What specific things about the seminar could be improved to better support student learning? (limit to 3):

this seminar works perfect in this actual situation & is suitable

I think the student is gathering more knowledge combining the theoretical part with the practical one, thus I suggest that the seminars should have 50%-50% theoretical-practical. At a few points, slower presentations or short breaks might be needed to understand and think about the information that was delivered to the viewers. To engage viewers for questions, an idea might be to ask specific points that the presenters would like to hear the viewers opinion on, since right after the presentation most viewers will be busy thinking about what they just heard, taking notes and attempting to make up their own mind on the topic.

The interactivity. The remote application has not so high impact like the physical participation!

more interactive but not too much -> i think the presentations could ask some questions in order to engage the audience more

Show more examples of what have been done so far with the specific technology.

maybe i could be a little bit more interactive

At some point i couldn't understand well because of different accents, not so bad, but it will be nice to speak a little slowly so we can process the information, especially if there're new audience with none or minimum knowledge about topic

If there is a lot of information in presentation, it would be ok the professor have a few breaks in presentation like 10-20 secs.

-more applicative topics in university

test

Further practical demonstrations would be interesting.

More practical approach - examples, problems, use cases

for students with no previous experience with ADOxx a brief introduction would be beneficial

What are the strengths of this seminar?

to offer this seminar online is suitable to combine interested people from different countries, hope will see all together in physical way as soon as possible

The down side I think is the fact that the information is acquired better if you attend the seminar physically, but on the other side you can still attend at the seminar from anywhere around the globe without any problem and there is no actual big difference. Overall, the seminar being developed in online manner it's a rather good idea, in my opinion.

No need to spend a lot of hours (few days) travelling. No opportunity to meet with interesting people.

Benefits: more flexibility, same view of the projects and experiments for everyone

Disadvantages: no means of communicating with the presenters and attendees 1 on 1

The most benefits consists in dissemination and wide spread and large participation. The disadvantage: the physical participation especially when you want to see some simulation of physical devices.

+ easy participation - it's more "far away" As there is no open comments section, i would like to add here that in the year 2021 it is absolut inadaptable to have this kind of event with only men. Having only men talk and a female moderator is nothing else but tolkenism and that is as bad as having no representation. If there are really no women in this field, there should be some serious design think done, in how to change that.

you can join from everywhere. It is less interactive.

benefits are that it is possible to do the seminar during the pandemic and it is easy to access from different countries. disadvantages are that some things can't observed or tried out via camera as if it would be face to face.

Disadvantage: Loosing internet connection for a short period of time as i just experimented :(

benefits: more people can attend, no need to travel

test

Unfortunately, if the seminar had not been online, I would not have been able to participate (because of an appointment directly afterwards). On the other hand, the online format means that the exchange of ideas is somewhat lacking.

Benefits - larger audience Europe/Worldwide

benefits: location independent participation, more people interested in the topic have the possibility to join, format suitable for introduction into topic disadvantages: for more in-depth workshops offline seminars might allow for deeper understanding

This seminar is developed in an online manner. What do you think are the most important benefits and disadvantages of such a development?

the mixture of theoretical & practical aspect concerning the presentations as well as the fields of the presentations coming from

Creating an idea of how the factories of the future will look like in the next years.

Variety of topics, different presenters, each with their own strengths and modes of presentation.

It tackle up to date things regarding digitalization.

it is a really relevant topic

bringing practical knowledge into the classroom

various topics presented by people from different countries, so it feels very international

Very nice introduction with instruction using the platform as not everyone is familiar with

zoom Different specialists talking about topics Cursive presentations, well prepared

The variety of topics covered.

very diverse topics, multiculturality, different viewpoints and approaches

test

Practical applications were shown. Furthermore, the lecturers took turns. If the course had been led by only one lecturer, it would not have been as exciting.

Insights in very actual and interesting themes Very competent and engaging presenters

overview of theory and application open source materials provided

NEMO DAY May

What specific things about the seminar could be improved to better support student learning? (limit to 3):

- more practical example - short hands-on session

It needs more interaction between students and lecturers.

A virtual room for the informal and mutual exchange

more case studies and practice experiment

this seminar works perfect in this actual situation & is suitable to bring professors and students together

Probably try to give students some material to check before participating to the seminar.

More interactive presentations. More demonstrations/practical experiments instead of theory. More sharing of the event, to allow to more students to participate.

the sound quality was sometimes quite poor a 15 minute break would be nice

What are the strengths of this seminar?

Advantage broader audience and flexibility Disadvantage difficult feedback

Benefit: large audience Disadvantage: lack of social/technical interaction

Benefits: No traveling needed Disadvantage: no social interaction

Recording - you can watch it again, more people can participate easily. Due to no personal meeting, less contact to the persons

The main advantage is that I can follow the seminar even if I'm not in that place, and I can rewatch the seminar thanks to the online registration. The disadvantage is that you haven't direct contact with the teacher

to offer this seminar online is suitable to combine interested people from different countries, hope will see all together in physical way as soon as possible

Benefit: we can easily participate Disadvantages: it is difficult to interact in the online manner.

Benefit: easy access for students from different locations, countries. Disadvantage: low level of interaction between presenters and students.

easy participation interaction is more difficult

Lack of human interaction is a disadvantage

This seminar is developed in an online manner. What do you think are the most important benefits and disadvantages of such a development?

- very good presentation of very interesting topics in relatively short time

The high number of experts and variety of applications around OMiLAB laboratory/network.

The Applied approach

Showing the successful researches and the innovation behind it is motivating for the students.

easy to understand, very interesting and various

the mixture of theoretical & practical aspect concerning the presentations as well as the fields of the presentators coming from, and to be able to join this seminar session in a digital way

The topics are really interesting and the seminar was really well organized.

Topic are fresh, interesting for everybody, information is up-to-date

it was very interesting I was introduced to lots of new information and topics it is "on the puls of time" - i see myself using some of the information in my future job

Annex C Questionnaire for The industrial transition towards Product-Service-Systems: articulating enterprise modelling and economic model balancing, Prof. Xavier Boucher

Lecture and materials

Subject matter(s) and industrial knowledge brought by the teacher was relevant regarding Industry 4.0?	Strongly disagree	Strongly agree
How satisfied are you by in the time management	Not satisfied	Really satisfied
How satisfied are you in the topic(s) of the training?	Not satisfied	Really satisfied
The lecture increased my knowledge of product service systems	Strongly disagree	Strongly agree
The lecture helped me in understanding meta modelling	Strongly disagree	Strongly agree
The lecture helped with understanding the modelling of Product-Service Systems	Strongly disagree	Strongly agree
Commends or Recommendations about lecture and materials		

Misc questions

Were prior IT (especially modelling) knowledge and skills required?	No	Yes
Were prior knowledge needed in the economic field (business management)?	No	Yes
The topics of the event are similar to what I was expecting	Disagree	Agree
How useful Is the information I got for my future projects or career development?	Not useful at all	Extremely important
This class has increased my interest in this field of study.	Coure decrased my interest	Course increased my intrest
The interaction between organisers and participants was relevant	Strongly disagree	Strongly agree

Open questions

What are the strengths of this lecture?
 What are one to three specific things about the lecture that could be improved to better support student learning?
 Other commends about the lecture

Annex D responses from open questions for The industrial transition towards Product-Service-Systems: articulating enterprise modelling and economic model balancing, Prof. Xavier Boucher

Comments about lecture:

The presentation was nice.

Bonne conférence

This lecture was really interesting, I didn't know so much about PSS and I can understand it.

Thanks to prof. Boucher.

It's a good conference and important.

great

It's perfect, I don't have any recommendation

I am an industry practitioner that interacts with this field of knowledge. From my perspective, I felt I understood the core concepts; however, the slides were "busy" and some more basic background would be good based on the NEMO 2021 audience makeup.

A very important subject and interesting material

very interesting this new 4.0 industry changes the business model

Great presentation and very interesting for me and my direction in the future.

No

No specific comments

The lecture was really interesting, full of visualization and nice examples through the presentation.

No comments

It was good. Very good.

The topic is very complex, so professor presented just a general outline, there was no time for explanation details

It would be interesting to have a hands on session using ADOxx on this methodology or a working case study.

The materials are great.

I don't know.

merci, bonne travail

Good point to further cases.

Strenghts

Good presentation and high-quality slides.

To me, the transversal and principal strength was the easy and quick explanation about PSS.

Practical input

Presentation, information, and their learning innovations. New and very useful methods in all areas.

criticity; management; interaction

I think this is relevant with today's pacing world that service will be very important.

A lot of good ground was covered and I am looking forward to following up on some of the content elements and references.

- well structured- visualisations

A height quality content and interesting information given by the lecturer
the evolution of this model.

The relationship between the topic of product-service-system was very clearly explained. A very interesting and detailed explanation of research methodology can be very important for early-stage researchers.

knowledge and commitment of the trainer

Interesting presentation of the topic; the topic is currently actual

Clarity Good explanation

Connection between technology and oikonomy.

The PSS idea is great

Great introduction to the field of smart PSS.

I am acquiring more knowledge

Deep knowledge about what is PSS

The fact that we could learn more about a tool that is being used in the business environment and that provides value to the business ecosystem.

claire globale évolué

What are one to three specific things about the lecture that could be improved to better support student learning?

Elaboration using more examples.

1. More explanation about the examples

In some cases, the pictures in the transparency are so tinny.

Higher audience involvement.

It's an excellent conference, I wish you a good continuation
time; accessibility;

None I can think of.

At NEMO 2021 there is a mix of people that have little to no real-world experience and likely lack a background, there are also academics that have the background but may lack industry experience, then there are people like me who have both academic and industrial experience of the topic. Given the short time allowed for the presentation, I would suggest a concepts introduction slide or slides to frame important academic and industry aspects.

- specify the audience of interest

the presentation and the accent

more time for the lecturer, in order that he could explain more information about it.

Research Methodology literature and materials

I did not notice

Student inclusion,..

No

1)The remarks

2) the conclusions

3) the representations

More details on technology, on management, and on user acceptance

Break it down so that there is more time to explain and present topics in more depth.

Nothing

Allocating more time to this topic

Would be nice to learn more in detail about the implementation of the tool in the real world use cases.

assurer plus de temps pour l'explication utiliser des applications plus simple

Other comments

This is an important area for educating future engineers and ICT people and I am pleased it was featured at NEMO 2021.

Additional literature connected with research work

Thank you once again for really interesting presentation :)

No

no comments

None

merci

Annex E

Service Engineering models for the design and development of Digitalised Product-Service Systems, Prof. Dr. Sergio Cavalieri & Assoc. Prof. Giuditta Pezzotta

Lecture and materials

Subject matter(s) and industrial knowledge brought by the teacher was relevant regarding Industry 4.0?	Disagree	Agree
How satisfied are you by in the time management	Not satisfied	Really satisfied
How satisfied are you in the topic(s) of the training?	Not satisfied	Really satisfied
The lecture increased my knowledge of product service systems	Strongly disagree	Strongly agree
The lecture clarified the role of Service Engineering models in the industry 4.0	Strongly disagree	Strongly agree
The lecture helped with understanding Service Engineering models	Strongly disagree	Strongly agree
Comments or Recommendations about lecture and materials		

Misc questions

Were prior IT (especially modelling) knowledge and skills required?	No	Yes
Were prior knowledge needed in the economic field (business management)?	No	Yes
The topics of the lecture are similar to what I was expecting	Disagree	Agree
How useful is the information I got for my future projects or career development?	Not useful at all	Extremely important
This class has increased my interest in this field of study.	Course decreased my interest	Course increased my interest
The interaction between organisers and participants was relevant	Strongly disagree	Strongly agree

Open questions

What are the strengths of this lecture?	
What are one to three specific things about the lecture that could be improved to better support student learning?	
Other comments about the lecture	

Annex F responses from open questions for Service Engineering models for the design and development of Digitalised Product-Service Systems, Prof. Dr. Sergio Cavalieri & Assoc. Prof. Giuditta Pezzotta

Comments about lecture

important subject and the method used for modalisation is well explained

Since I'm not in the field I found it interesting.

None

The topic is rather known

Very clear and engaging.

Excellent conference

Very well

c'est bien merci

I really enjoyed the start with the main research streams of PSS

It was a very interesting lecture.

Very interessting

very objective and interesting

Main strenghts

Inspiring lecture and case.

the slides used explained well the topic of study

The explanation of the role of engineering model in the digitalisation PSS. And how it was modeled.

Very well explained

Slides

The figures of the presentations

Very related to Industry 4.0 era.

All is well

Usefull session

c'est le domaine de future

permet d'améliorer les produits et reduire les couts ainsi qu'une bonne satisfaction des clients

Providing understandable examples, and showing where the future research problems are

The processed teaching materials covered really interesting areas related to the development of Digitalized Product-Service Systems.

I have learnt alot

time management, engagement

Main improvements

Discuss a case study.

Give more time to participants to ask their questions

The modeling phases and its adaptability to other field.

Make material available since the beggining of the lecture so we can explore together with the presenter without relying solely on the current presentation slide

Focus on more precise presentation of cases

1) Analyse more the part of Ontologies. 2) Give specific examples. 3) Organise a web laboratory.

Hands-on workshop will be beneficial.

Excellent conference

Nice presentation

a clarifier le "PSCT" Product Service Concept Tree

In the 45min lecture of course students were missing the hands on part, but nothing a little homework cannot correct

Since the lecture was interesting to me, I have no suggestions for improving it.

Non

more previous supporting materials;

Other comments

no

Nothing

Bonne travail merci à tt

None