



ADSEE project
Applied Data Science Educational Ecosystem

Intellectual output 4:
Development of pilots and pilots' analysis

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Introduction

In order to develop the pilot process (Intellectual Output 4), the educational modules elaborated in Intellectual Output 3 were integrated into the learning environments of project partners using the developed platform. Moreover, pilot process actually represents phase of the ADSEE project when all previously developed results had to be used in order to successfully conduct the pilots in partners' learning environments. The pilots were conducted by all higher educational institutions which are ADSEE project partners. Algebra University College established evaluation tools which were used by all project partner in order to obtain data for further analysis. University of Amsterdam was responsible for organizing the pilot process and preparing a report on pilot execution and evaluation analysis.

As a final result, report on Intellectual Output 4 of the ADSEE project contains:

- a) insights gained during the process of piloting obtained by:
 - University of Amsterdam (Netherlands)
 - Algebra University College (Croatia)
 - German National Library and Leibniz Information Centre for Science and Technology (Germany)
 - Faculty of Information Studies (Slovenia)
- b) the results of the pilot process - evaluation of the pilot efficiency and success-rate of the produced educational modules

1. The aim and objective of the ADSEE project

The main objective of the ADSEE project is to deliver useful educational and training program in data science (DS) through: development of educational modules, adaption of contents and methods according to envisaged needs of the target groups, creation of interactive didactic tools and production of guidelines and recommendations on innovative education approaches in DS.

Special attention is paid to data science in non-technical universities and its application in nontechnical business, where previous knowledge in this area is not mandatory. The innovativeness of the project lies in the modular approach allowing tailor-made courses development, according to the participants' specific prior knowledge and competences (or in absence of that knowledge and competences) and in a fully functioning online piloting repository which contributes to the development of participants' new skills and experiences.

The aim of the project is to contribute to the popularization of data science among wider public. The main target groups are higher education institutions and HEIs' employees, students, business/industry sector, institutions (ministries of labour, national employment agencies, employers' associations) and Digital Innovation Hubs (DIH). ADSEE project addresses individuals with in-depth knowledge about data science, those who are attending technical universities or are working in data science related sectors and individuals who know data science exists, are aware of its potential but still without an expertise to make decisions based on data science.

2. Previous project results and accomplishments

In order to achieve the main objective of the project, partners have accomplished a few results before conducting the Intellectual Output 4, all of which are finalized and were crucial for successful implementation of the pilot process.

- Intellectual Output 1: Project partners delivered the report with the analysis of academic supply of the study programmes related to data science accessible at HEIs and other education providers in partner countries and, on the other hand, analysis of the current market needs in terms of competences and experience required for data scientist and other occupations using data science approach.
- Intellectual Output 2: Project partners have designed the interactive online repository based on the analysis conducted as part of the Intellectual Output 1, especially using inputs obtained from the target groups. Based on these inputs, project partners developed a fully functioning interactive online repository that covers two main functions. It represents a part of a personalized training mechanism which can contribute to the development of users' new skills and experiences by delivering educational/training material in full-scale training case, filling the gap for increasing demand and limited supply of business efficient approach in training methods. The repository was further used for hosting the learning materials. To access the repository, users log in using their existing account which guarantees a free access to the newly developed repository.

- Intellectual Output 3: Project partners have created four educational/training modules with a special attention to the non-technical sectors and covering a wide range of different industries and cross-domain topics (Retail and marketing, Culture and Tourism, Privacy and Job Market Signalling). All created modules are driven by industry and interdisciplinary examples and can be used as an improvement of current learning modules, as core part of new learning modules or for the self-study. Thanks to the modular approach used to develop educational and training materials, all modules are transferable and applicable in any study program, since they are structured as a flexible end-to-end business case avoiding a pure data scientific approach. Modules follow “from business problem to business usage” principle in order to fill in the gap between increasing demand and limited supply of practical training methods in data science approach to the business sector.

3. Pilot aim and methodology

3.1. The aim of the pilot process

The aim of the pilot process was to deploy and test the educational modules developed in the Intellectual Output 3 in encounters with the different target groups (people with different educational backgrounds and professional experiences) and in different local, regional and national environments. The data about the effectiveness of the pilot process and success-rate of the produced educational modules was obtained.

The main objective of the pilot process is twofold. On one side, it will support partners in their effort in planning, implementing and evaluating of innovative and efficient approaches in data science learning, and, on the other, will contribute to the popularization of the data science among widest audience piloting real cases selected among different industries (especially non-technical ones).

3.2. Institutions included in the pilot process

The pilot process was conducted by the following institutions:

- University of Amsterdam (Netherlands)
- Algebra University College (Croatia)
- German National Library and Leibniz Information Centre for Science and Technology (Germany)
- Faculty of Information Studies (Slovenia)



Project partners mentioned above participated actively in the Intellectual Output 4 by running the pilot process. in their own institutions. In order to implement previously created educational modules into the learning environment, German National Library and Leibniz Information Centre for Science and Technology ran the pilot process on the University of Siegen.

Algebra University College established evaluation tools which were used by all project partner in order to obtain data for further analysis. University of Amsterdam was responsible for organizing the pilot process and preparing a report on pilot execution and evaluation analysis.

3.3. Target group of the pilot process

Piloting process started with the involvement of two main target groups:

- a) people with in-depth knowledge about data science, those who are attending technical universities or are working in data science related sectors
- b) individuals who know data science exists, are aware of its potential but still without an expertise to make decisions based on data science.

Therefore, both data science students and non-data science students fall within the scope of the piloting, including people already employed in different industrial sectors.

3.4. Selection of the pilot process content

Pilot process was conducted by HEIs that are included in the ADSEE project, in a way that every project partner ran the pilot process, including the previously developed educational modules into a particular ongoing modules or educational trainings. In the beginning, project partners have chosen the materials for piloting and modules/educational trainings during which materials were piloted. This way, created applicable use-cases were linked with existing modules or education trainings in order to show the possible ways of implementing data-science approach.

3.5. Running the pilot process

Each partner organized running the pilot internally. Partners could arrange the pilot as a face-to-face training or in an online environment – depending on the current COVID-19 restrictions. Either way, the pilot process participants had to carry out all following steps:

- conducting the survey before the pilot process - students
- testing the educational modules

- conducting the survey after the pilot process – students
- conducting the survey after the pilot process – lecturers

4. Results of the survey conducted before the pilot process

Algebra University College created online questionnaire in English using the Google Forms. Afterwards, all partners were in charge of distributing the questionnaire to students – pilot participants. All pilot participants had to fill in the questionnaire before the start of the pilot process, during which they had the opportunity to test the educational modules and gain some knowledge about implementation of data science approach in non-technical business. The aim of this questionnaire was to investigate participants' previous knowledge about the data science, their opinion about including data science approach into the business process and what they expected to learn and achieve by participating in the pilot process.

In total, 212 students from Netherlands, Croatia, Germany and Slovenia participated in the pilot process. As previously emphasized, the aim was to include students with different educational backgrounds and professional experiences into the pilot process. Results of the survey conducted before the pilot confirm that this aim was accomplished. Namely, pilot participants had diverse educational backgrounds but majority of the pilot participants (70 %) marked social sciences-business as field to which their current job position belongs to (Figure 1). 17 % of the pilot participants marked interdisciplinary sciences and 11 % natural sciences as their fields of expertise. Both (bio)medicine and humanities were marked with 1 %, and none of the pilot participants marked biotechnical sciences and arts as their field of expertise.

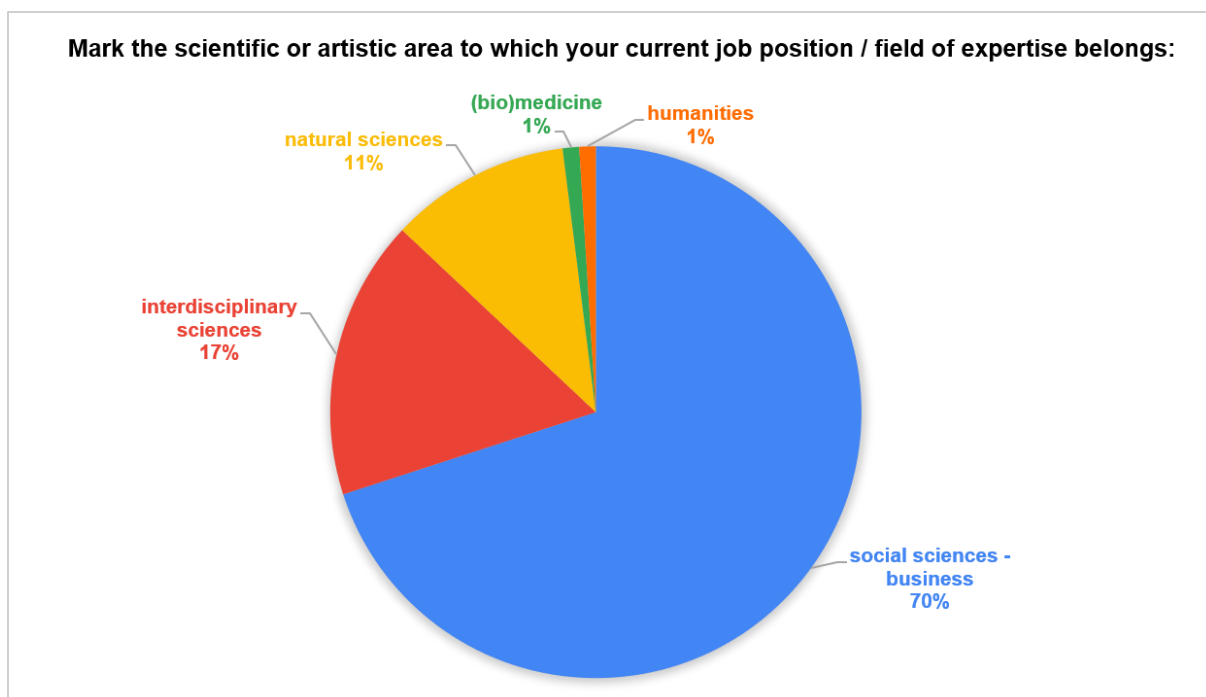


Figure 1. Pilot participants' fields of expertise

It can be concluded that missions of the ADSEE project have found a fertile environment during the pilot process, having in mind that majority of the pilot participants were currently employed in the business sector and that sector is one of the most interesting for project partners to promote data-science approach and methods.

Furthermore, the target group encompassed both students with an in-depth knowledge about data science (those who are attending technical universities or are working in data science related sectors) as well as the individuals who know that data science exists, are aware of its potential but still without an expertise to make decisions based on data science. Based on that fact, one of the questions for the pilot participants were to assess their general knowledge about data science. Only 4 % of the participants pointed out that they were not familiar with data science at all, and 37 % of the participants were only familiar with the term data science (Figure 2). Moreover, small share of the pilot participants (9 %) were the ones who could describe in detail what the data science is about. Majority of the pilot participants (50 %) pointed out that they could describe in general what the data science is about. This situation was also favourable for conducting the pilot, since majority of the participants have previously heard about data science but were not aware of its potential. This shows that pilot was an opportunity for majority of participants to gain new insights into data science approach or to become acquainted with data science methods.

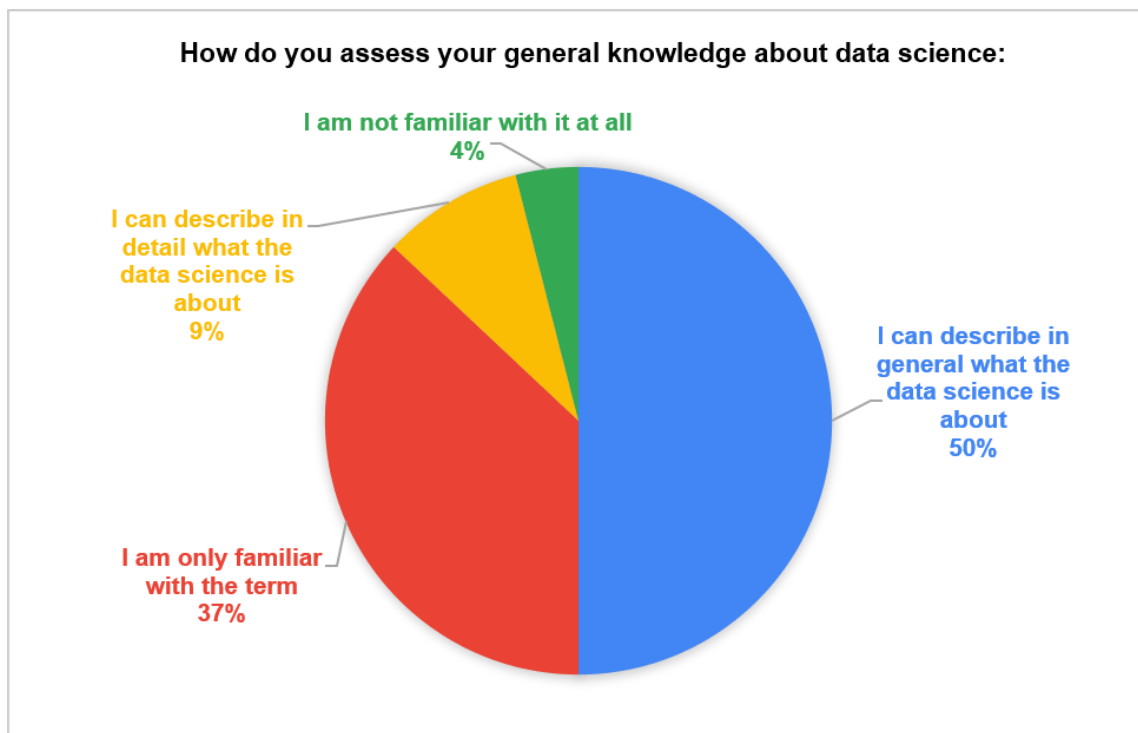


Figure 2. Pilot participants' general knowledge about data science before the pilot process

In order to investigate participants' motivation for pilot activities, participants were asked to assess their interest in data science, using the simple numerical scale from 1 to 6. Most participants (57 %) were interested in data science above average (Figure 3). Since one of the objectives of the pilot was to contribute to the popularization of data science among audience from different industries, target groups' characteristics and interests proved to be favourable. The

higher the interest for data science, the more motivated participants for gaining new insights and knowledge.

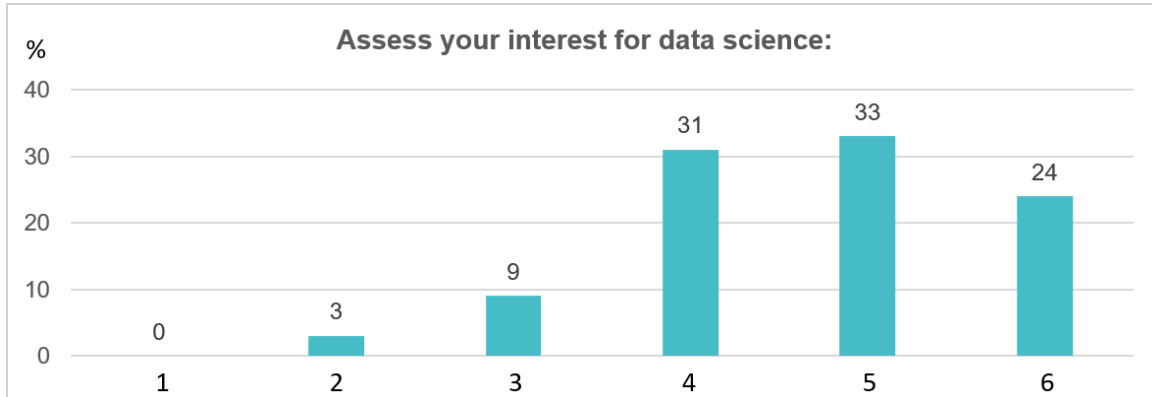


Figure 3. Pilot participants' interest for data science before the pilot process

Additionally, participants were asked to express their opinion about applying data science in their field of expertise. Majority of the pilot participants (63 %) pointed out that, in their opinion, it would be very useful to apply data science in their field of expertise (Figure 4). Just under a third of participants (30 %) thought that applying data science in their field of expertise may be useful, but were not so certain. Minority of the participants were not sure if data science could be useful in their field (5 %) or they pointed out that that do not know (2 %). It can be concluded that majority of the participants, before the pilot process, thought that business in which they work could benefit from implementation of data-driven approach and data science methods. Based on these results it can be concluded that pilot participants were eager to find out how to benefit from data science in their field of expertise.

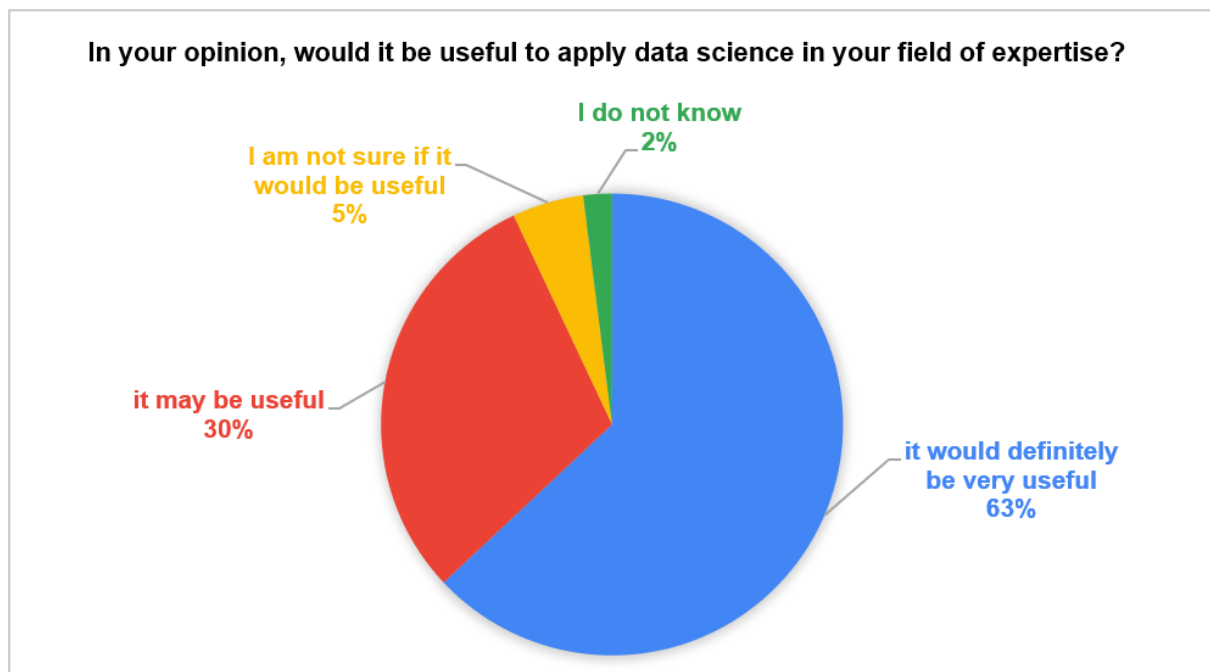


Figure 4. Pilot participants' opinion about usefulness of applying data science in their fields of expertise before the pilot process

Following the previous question, pilot participants were asked to assess what impact they expect that data science could have in their field of expertise (using the simple numerical scale from 1 to 6). Most participants (72 %) expected great impact of implementing data science in their field of expertise (Figure 5).

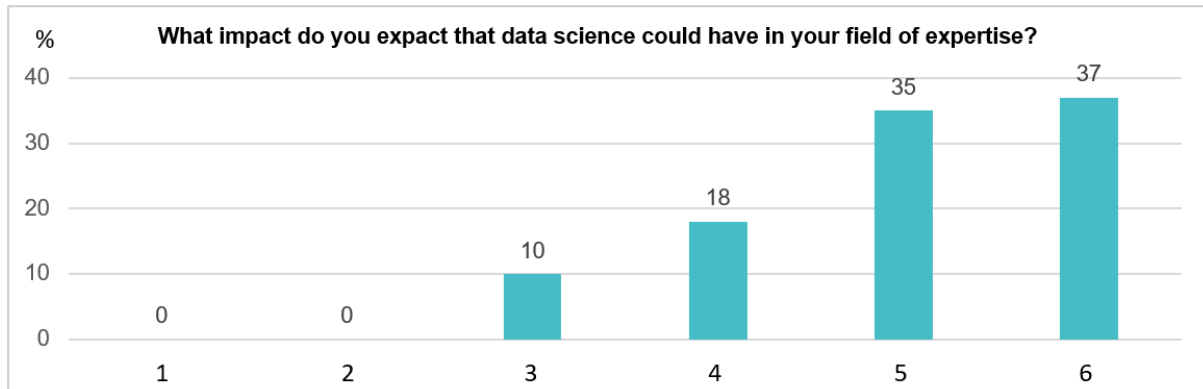


Figure 5. Pilot participants’ assessment of data science impact in their field of expertise before participation in the pilot process

Moreover, questionnaire also investigated whether pilot participants had any ideas about possible ways of applying data science in their field of expertise (Figure 6). Results show that majority of participants were thinking about it, but do not have a clear idea (37 %) or they think that they need to learn about the possibilities of data science application in order to start thinking about it (30 %). Part of the participants pointed out that they knew exactly how to apply data science in their field of expertise (28 %) and 5 % of the participants did not have any idea.

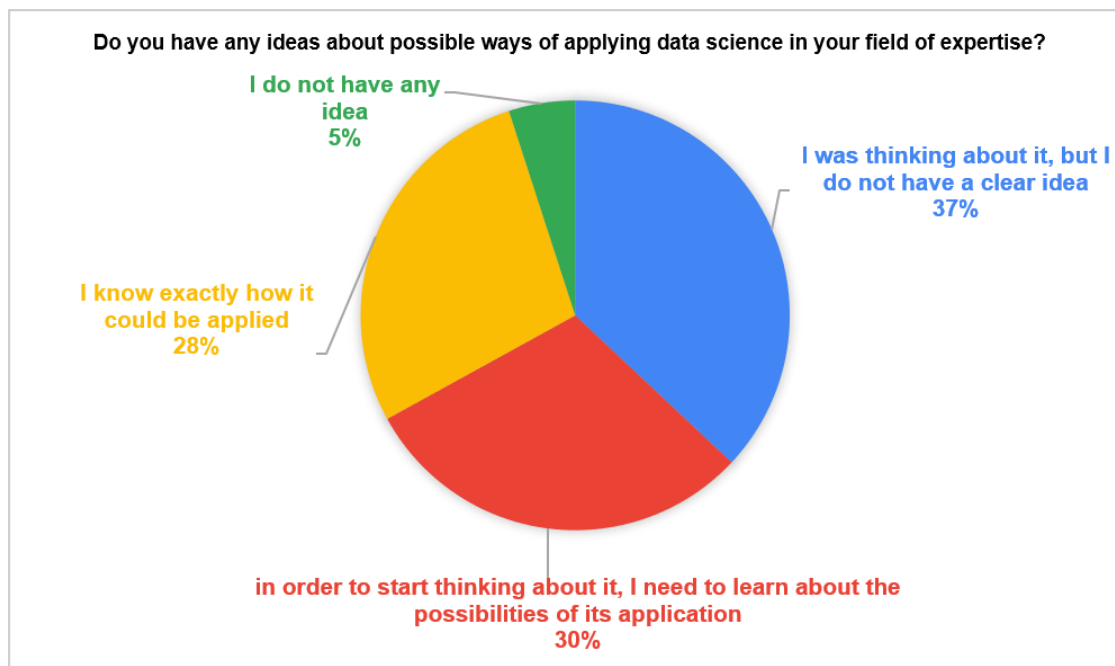


Figure 6. Pilot participant’s ideas about possible ways of applying data science in their field of expertise before the pilot process

In conclusion, business is area to which majority of the pilot participants' job positions belong to. Before the pilot, most of the pilot participants were only familiar with the term data science or they could describe in general what data science is about. Before conducting the pilot, participants expressed significant level of interest for data science and majority of participants thought that data science could be very useful if applied in their field of expertise.

5. Pilot process – testing the educational materials

5.1. University of Amsterdam

On the University of Amsterdam (Netherlands), the pilot process was held from 13th December 2021 to 17th December 2021. The course during which the ADSEE pilot process was conducted was Business Analytics and during the lectures, ADSEE Privacy case was piloted. ADSEE educational materials that were used were whitepapers and slide decks. Total number of students participating in the pilot process was 120.

Majority of the students were students of Business Administration that chose the Business Analytics as an elective course. There was an even number of men and women in the student group. The characteristic of this student group was lower prior knowledge about data science and none to rare prior experience with data science related topics. Nevertheless, the students showed interest for acquiring new knowledge and skills and were very motivated to find a way to apply data science in their field of expertise (mostly business) after they found out what are the principles of data science and possible benefits of using data science approach in business.

5.2. Algebra University College

On the Algebra University College (Croatia), the pilot process was held from 3rd December 2021 to 5th December 2021 and duration of the pilot process was 16 hours. The course during which the ADSEE pilot process was conducted was MBA and during the lectures, ADSEE Retail case was piloted. ADSEE educational materials that were used were whitepapers, slide decks, Jupyter Notebooks, data samples and software codes.

Students that were part of the pilot group were mostly in their mid-thirties. Total number of students included in the pilot process was 30 out of which 11 students were women. Students that were included in the pilot belong to different fields of expertise, but, in the questionnaire conducted in the beginning of the pilot, majority of the students pointed out that their field of expertise belongs to 'social sciences – business'. Majority of students are C-level executives or candidates as well as SME owners. Having said that, most of the students involved in the pilot are innovators – either in their own entrepreneurial venture or company in which they work. This is why students were very interested in finding an innovative and effective strategy for fostering their business endeavours.

5.3. German National Library and Leibniz Information Centre for Science and Technology

In order to implement previously created educational modules into the learning environment, German National Library and Leibniz Information Centre for Science and Technology ran the pilot process on the University of Siegen. On the University of Siegen (Germany), the pilot process was held from 20th January 2022 to 3rd February 2022. The course during which the ADSEE pilot process was conducted was Software Engineering and during the lectures, ADSEE Job Marker Signalling case was piloted. ADSEE educational materials that were used were whitepapers, slide decks and Jupyter Notebooks. Total number of students participating in the pilot process was 49.

Students were mostly male and their average age was around mid-twenties. The ADSEE pilot was given as part of the Software Engineering course, focussing on the planning, designing and organising software creation as well as on the management of small software development teams. The course is given as part of the master studies Mechatronics and, as such, is majorly visited by Mechatronics students. Mechatronics is a mixed discipline, combining knowledge from the fields of electrical, mechanical and software engineering, with a strong focus on the first two. When entering the class in the third semester, students have mastered either a mechanical or electrical engineering bachelor program and have no or fundamental knowledge in software engineering. While the mathematical base for understanding methods from the field of data science is given, a structured analytical understanding is usually yet in development. The ADSEE pilot was well received by students who started to deliberate about possible ways of data science application in software engineering, after participating in the pilot.

5.4. Faculty of Information Studies

On the Faculty of Information Studies (Slovenia), the pilot process was held on 24th November. The course during which the ADSEE pilot process was conducted was Theories of Information Studies and during the lectures, ADSEE Cultural Heritage and Tourism case was piloted. ADSEE educational materials that were used were whitepapers, slide decks and Jupyter Notebooks.

Students included in the pilot were part of the Informatics in Contemporary Society programme, BA level. The aim of the programme is to provide students with basic knowledge in the field of social sciences, broaden their knowledge of social science research methods and gain ICT skills, so that students would be able to apply information technology methods in developing solutions needed for the modern society. Total number of pilot participants was 13. Although students' previous knowledge was predominantly related to social studies and ICT, data science was an interesting topic to them, since they showed that they are well aware of data potential for business development.

6. Results of the survey conducted after the pilot process

Algebra University College created online questionnaires in English using the Google Forms. Afterwards, all partners were in charge of distributing the questionnaire to students – pilot participants as well as to the lecturers engaged in the pilot. Students and lecturers had to fill in the questionnaire after conducting the pilot process.

The aim of this questionnaire was to investigate students’ interest for applying data science in their field of expertise in the future, students’ assessment of pilot impact on their data science capacity as well as their opinion about the quality of tested educational materials. In addition, questionnaire for lecturers investigated level to which lecturers used data science findings in teaching before the pilot, their interest in further usage of data science approach in teaching as well as their opinion about practicality and quality of educational materials.

6.1. Analysis of the students’ responses

Although pilot participants were interested in data science as a topic before the pilot started, results of the questionnaire conducted after the pilot process are even more significant. Participants were asked to assess their interest for applying data science in their field of expertise after participating in the educational module. Participants assessed their interest using the simple numerical scale from 1 to 6 (Figure 7). Majority of the pilot participants (66 %) pointed out that they are very interested in further implementation of data science methods in their everyday work.

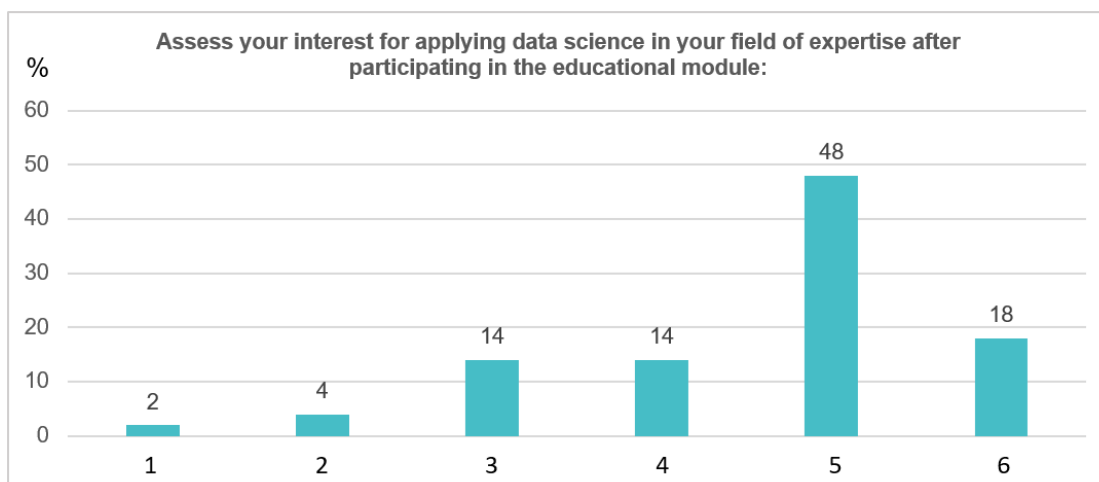


Figure 7. Pilot participants interest for applying data science in their field of expertise after participating in the pilot process

Additionally, the questionnaire continued to gather pilot participants’ opinions with a set of questions that were similar to the questions in the survey conducted before the pilot process. The aim of this set of questions was to compare participants’ responses before and after engaging with

data science approach. After getting acquainted with data-driven decision making and other data science methods, only 5% of the participants were not sure if applying data science in their field of expertise would be useful (Figure 8). The rest of the participants think that it would be very useful (53 %) or that it may be useful (42 %). Comparing to the results before the pilot, results after the pilot show more confident attitudes and participants' certainty about benefits of data science application.

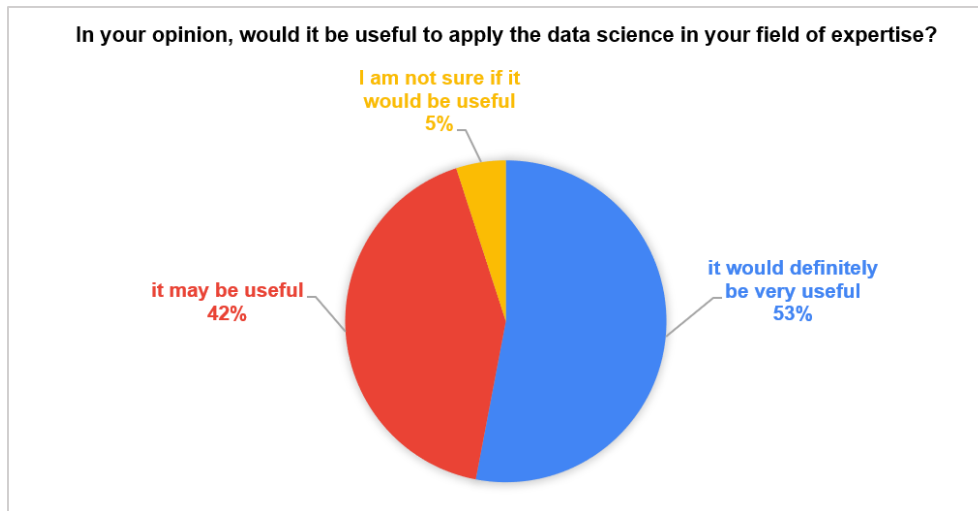


Figure 8. Pilot participants' opinion about usefulness of applying data science in their fields of expertise after the pilot process

In the same way, pilot participants showed that they have been thinking about details of applying data science in their field of expertise or that they were building the ideas about it, after participating in the pilot (Figure 9).

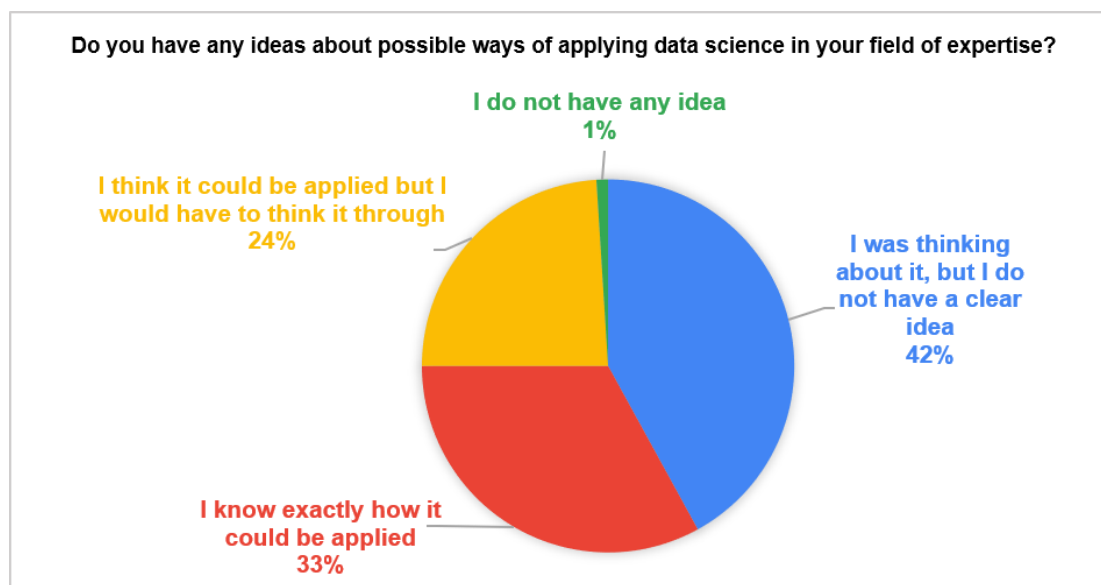


Figure 9. Pilot participant's ideas about possible ways of applying data science in their field of expertise after the pilot process

Furthermore, general pilot participants' satisfaction with the educational module and their opinion about its usefulness for acquiring an insight into benefits of using data science was investigated. According to the survey results, majority of the students (44 %) marked that educational module was useful and 9 % of the students emphasized that module was very useful for gaining an insight into benefits of data science and possibilities of business development based on data-driven decision making (Figure 10).

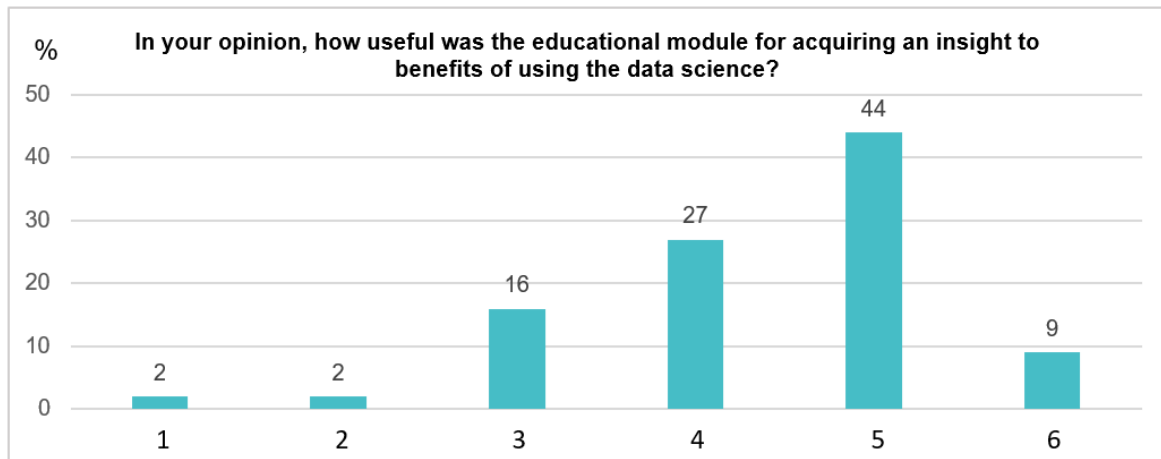


Figure 10. Pilot participants' opinion about educational module and its usefulness for acquiring an insight to benefits of using data science

The following set of questions investigated pilot participants' opinion about possible impact that application of data science approach could have in the particular business situations. It is important to emphasize that pilot participants deliberated about these survey questions after participating in the educational module where they had the opportunity to gain some insights about benefits of using data science approach in particular industries and/or fields of expertise. In the questionnaire, pilot participants marked the extent to which they agree with the four statements, using a simple numerical scale from 1 (strong disagreement) to 6 (strong agreement).

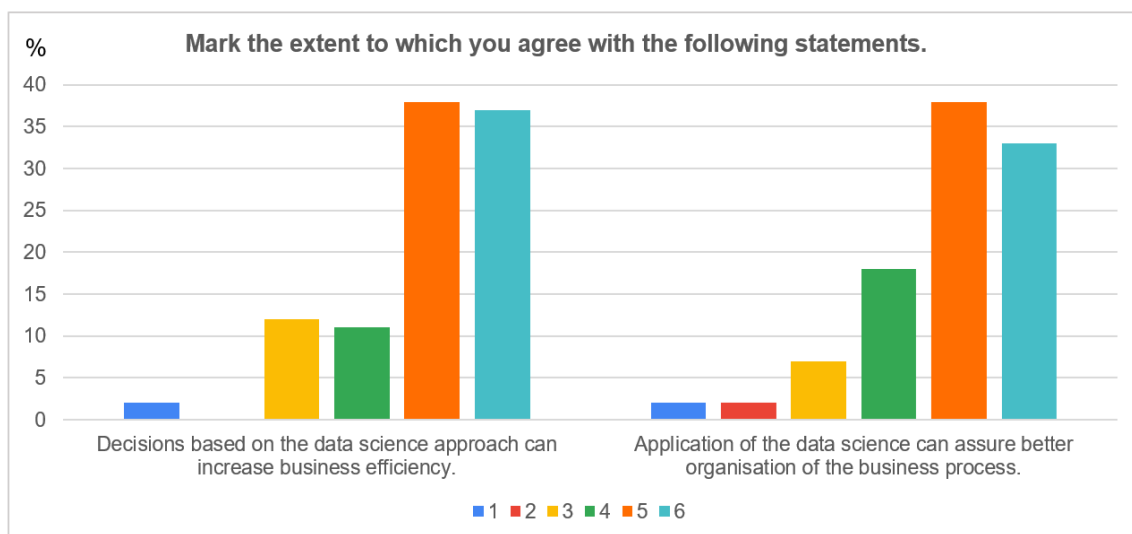


Figure 11. Pilot participants' opinion about possible impact of data science in business - 1

Majority of the students participating in the pilot thinks that data science approach can increase business efficiency – 38 % of the pilot participants agree and 37 % of pilot participants strongly agree with this statement (Figure 11). Besides, 38 % of the pilot participants think that application of the data science can assure better organisation of the business process.

Additionally, majority of the students who participated in the pilot (38 %) thinks that application of data science enables predicting of the future market trends. Moreover, 42 % of the pilot participants think that application of data science enables efficient analysis (Figure 12).

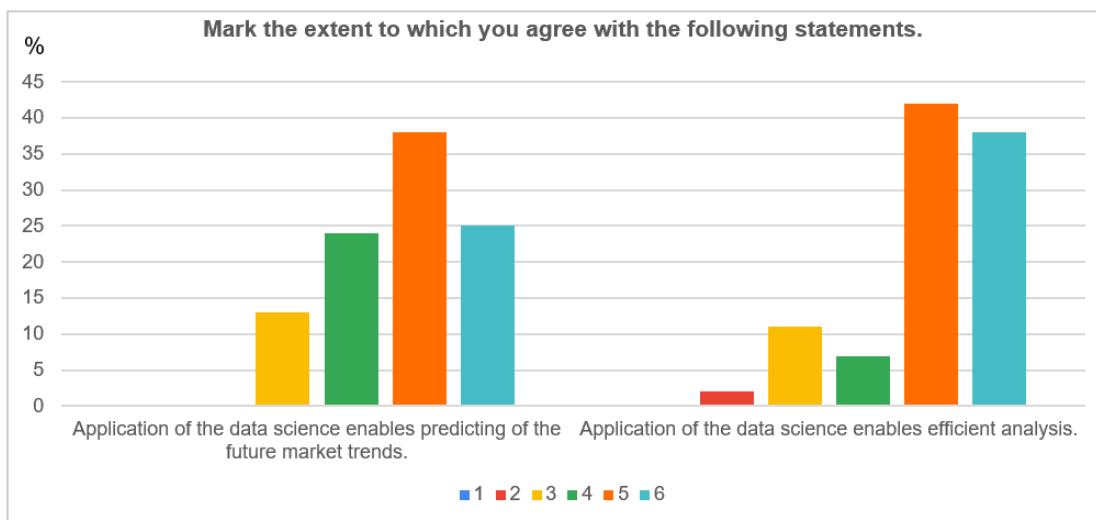


Figure 12. Pilot participants’ opinion about possible impact of data science in business - 2

It can be concluded that questionnaire results show students’ recognition of data science approach as highly useful and productive in many business situations. This means that pilot process helped them to recognize data science methods as methods which are not exclusively aimed for application in technical industries, but rather as methods that could bring benefits in many non-technical fields, especially business.

Furthermore, questionnaire investigated students’ opinion about educational materials which were used in the educational module (Figure 13).

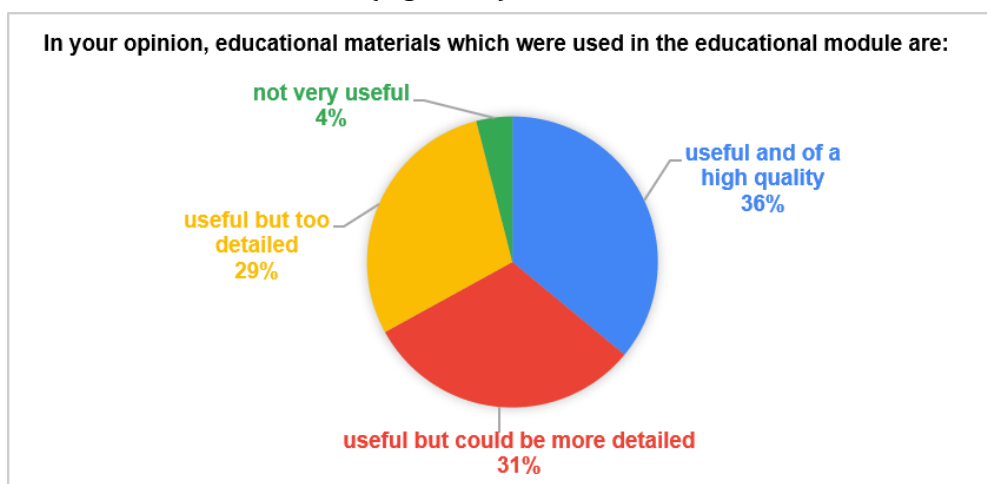


Figure 13. Pilot participants’ opinion about educational materials

Majority of the students (36 %) pointed out that materials are useful and of a high quality. Practicality of the repository with educational materials was also investigated – majority of the students who tested repository and its features assessed it as practical (38 %), grading it with 5 out of 6 maximum points.

Besides whitepapers and slide decks that were included in the educational materials, students had the opportunity to use data content on the Jupyter Notebook platform, and therefore gain some insights into datasets and operations with data. According to the questionnaire results, majority of the students (45,5 %) think that provided data content is useful and of a high quality (Figure 14). Practicality of the Jupyter Notebook platform was also investigated – majority of the students who tested the platform and its features assessed it as practical (40 %), grading it with 5 out of 6 maximum points.

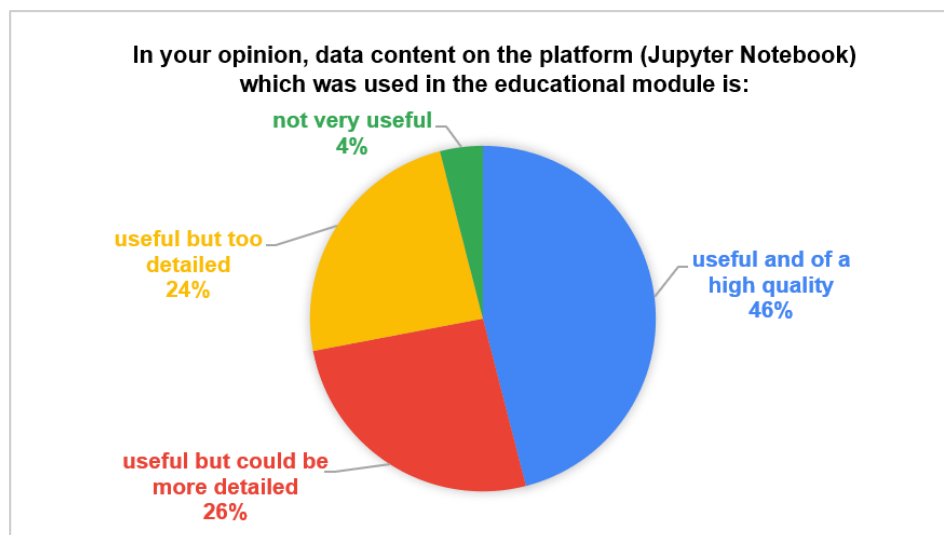


Figure 14. Pilot participants’ opinion about data content on the Jupyter Notebook platform

Finally, students who participated in the pilot were asked to choose one of the statements that describes their attitude toward applying data science most accurately. Majority of the students (47 %) pointed out that they are encouraged to deliberate about ways of applying data science in their field of expertise (Figure 15). This means that pilot process had a very positive effect on majority of the students, since they are encouraged to think about ways of applying data science methods in their everyday tasks. Above all, this means that this group of students did not have big previous knowledge about data science or ideas about its application in their field of expertise, but getting involved in pilot helped them to gain some new insights. Additionally, 26 % of the pilot participants emphasized that they developed an idea on how to apply data science in their field of expertise already during the educational module. This is very significant because it means that a bit more than quarter of the pilot participants had some previous knowledge about data science and participating in the pilot gave them an opportunity to develop their ideas about data science application, thanks to the educational module that showed them details about data-driven decision making and benefits of using data science methods. Furthermore, 26 % of the pilot participants pointed out that pilot process helped them to recognize the value of applying the data science in their field of expertise, but that they do not have an idea how to do it. This result is also very important, since it shows that further development and implementation of educational

modules and trainings about applying data science in non-technical industries is quite desirable. Only 1 % of the students participating in the pilot pointed out that they do not recognize the value of applying the data science in their field of expertise. Since more than 200 students have participated in the pilot process, 1% of the students who still do not recognize the value of data science approach is really a minority and these results could have been affected by low motivation or other personal reasons.

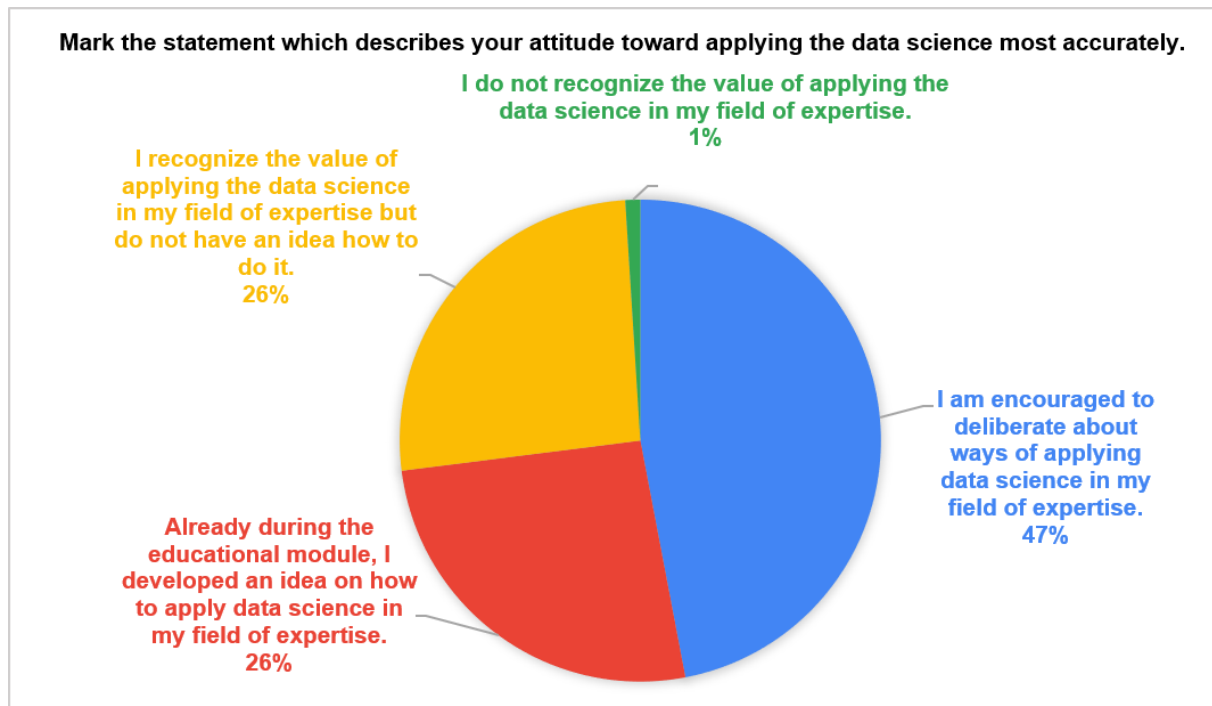


Figure 15. Pilot participants' attitude toward applying data science in their field of expertise after the pilot process

6.2. Analysis of the lecturers' responses

Lecturers who have ran the pilot process have also filled in the online survey in order to show the level to which they used data science findings in teaching before the pilot, their interest in further usage of data science approach in teaching as well as their opinion about practicality and quality of educational materials that were created by project partners.

In total, seven lecturers ran the pilot process on University of Amsterdam, Algebra University College, University of Siegen and Faculty of Information Studies. Majority of the lecturers (57 %) pointed out that their current teaching position belongs to interdisciplinary sciences and the rest of the lecturers (43 %) teach in the field of social sciences – business. This means that all lecturers teach non-technical content, which means that they have a great opportunity for teaching students about applying data science in those fields of expertise that are not technical, but could greatly benefit out of applying data science approach.

Furthermore, lecturers were asked about their general knowledge about data science. It is very significant that 86 % of the lecturers pointed out that they can describe in detail what the data science is about and 14 % of the lecturers can describe in general what the data science is about. These results show that lecturers who ran the pilot process have significant knowledge about data science. Having in mind that they teach in non-technical surroundings, it can be concluded that these lecturers could greatly affect on spreading the knowledge about application of data science – it is just important for them to find effective didactic strategies, since ADSEE project provided them with useful educational materials.

All lecturers pointed out that educational materials which were used in the pilot are useful and of a high quality, and all of them assessed repository as very practical. Majority of the lecturers (85 %) thinks that data content prepared on Jupyter Notebook and used with the students during the pilot is useful and of a high quality. It is interesting that 14 % of the lecturers pointed out that data content is useful but could be more detailed. This means that these lecturers have recognized the potential of involving students with that which require using the data sets.

All of the seven lecturers pointed out that using the ADSEE educational module helped them to explain the content of the particular lecture to the students more efficiently. Additionally, 86 % of the lecturers highlighted that students were more motivated than usually while using the ADSEE educational module for better understanding the content of the lecture.

When thinking about using the experience gained during the pilot process in the future, 43 % of the lecturers pointed out that they are interested, and 57 % of the lecturers that they are very interested for further using of ADSEE educational modules and similar materials. Additionally, majority of the lecturers are interested in implementing data science in their lectures in the future, based on the experience of participating in ADSEE pilot process.

7. Conclusions with recommendations

Results of the pilot showed that students' interest for applying data science in their field of expertise significantly increased after participating in the pilot. Accordingly, students who participated in the pilot have recognized benefits of applying data science methods and approach in their field of expertise. Additionally, students included in the pilot started to think about details of applying data science in their field of expertise. Moreover, lecturers who implemented the pilot process highlighted that students were more motivated for learning than usual, once they had the opportunity to learn about data science approach. Finally, after the pilot process, lecturers pointed out that they are interested in implementing data science approach in their lectures in the future.

Since one of the goals of the pilot was to familiarize students with data science and, therefore, popularize its methods and approach, it can be concluded that this goal was achieved. Conclusion is based on results of the pilot, which showed that students built their attitude towards using data science, while participating in the pilot process. For instance, after engaging with data science approach and methods, students think that decisions based on data science approach can increase

business efficiency and that application of data science can assure better organisation of the business process. Additionally, students concluded that data science enables efficient analysis and that application of data science enables predicting of the future market trends.

These conclusions significantly indicate that data science approach and methods could strongly benefit many businesses and that, therefore, learning about data science should be included in wider circle of educational and study programmes (which would enable learners and students to familiarize themselves with data science and learn how to use it in their field of expertise).

However, it is crucial to strategically implement teaching about data science in particular educational and study programmes. Firstly, it is important to determine which sectors and businesses could largely benefit from data science approach and further implement teaching about data science in corresponding educational and study programmes. Secondly, is it necessary to design learning path in chosen educational and study programmes in accordance with students' technical skills and future usage of data science in their field of expertise.

However, although digitalized data is exponentially expanding in its penetration across the full range of business sectors, there are few sectors (and therefore educational and study programs) which could benefit from data science approach. In general, data science could be beneficial in many different academic fields, including not only computer science related areas, but also social sciences and humanities. Areas which work with large quantities of data are definitely more likely to be beneficiaries of data science related approaches. A good example from the social science area would be educational studies or psychology. Moreover, data science could be very useful in fintech, business administration, e-commerce, migration, health-care, traffic, retail, tourism and culture.

Therefore, learning about data science methods and approaches should be included in appropriate educational and study programmes. An ideal data science program should include a real data-set which would be analysed during the program. For the beginners, the program should help learners to overcome lack of their technical skills and learn how to make conclusions out of analysed data sets. Also, it should clarify different steps of creating a data science-based solution: data collection, exploratory data analysis, creating model, and model evaluation. However, rather than targeting proficiency in the full range of data science skills, we feel that such modules ought to help learners to overcome lack of technical skills and focus on using data science approach and conclusions based on data analysis in wide range of fields – from setting up business strategies and models to predicting future trends and adapting business plans accordingly.