

Simulation of Corporate Work-life as a Part of Higher Education

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Abstract - The phrase "Data is the new oil" is becoming truer thanks to rapid technological development and our growing dependence on data. It is therefore very important that students' skills also include the ability to work with data (to search, understand, process, visualize, analyze, etc.). Today, data is used in decision-making and management in all areas of our lives. Therefore, also of Economics need to have an overview and experience in this field before entering the labor market. The long-term cooperation with the Deutsche Telekom IT Solutions company resulted in the idea of realizing a course where students would work with real corporate data during their studies, similarly to the employees in their normal working life. The course was created so that the leading employees of this company played an active part in its educational process. The paper presents the content and method of implementation of this subject, the results from its pilot run, and feedback from both, students and employees. Furthermore, the challenges that the pilot implementation of the subject posed to us in the coming years also are presented.

Keywords - Data analysis; Higher education; Educational process; Innovative teaching methods;

I. INTRODUCTION

The importance of employability of higher education institution graduates is an often-discussed topic not only on the political scene and at the universities, but also in the business environment [1]. We live in a world where technology plays a larger role in many aspects of our day-to-day lives and education is no exception. Advancements in technology have changed nearly every facet of the educational system; it has not just transformed the way education is delivered and received but also promotes outside-the-box thinking and innovation [2]. Massive open online courses, interactive whiteboards, virtual classrooms, augmented reality, and 3D printing, all of which support blended learning methods, are testaments to these changing dynamics of education [3].

Novel educational technology trends can help develop interesting learning experiences for students (e.g. virtual reality, augmented reality, gamification, blockchain technology, virtual learning, and cloud technology). Thanks to them we could change and innovate the learning process in different ways to be very close to our students [4].

As trends like big data, machine learning, and the Internet of Things (IoT) have come into the picture, many educational institutions have been focusing on how they can adopt them. According to Holon IQ, in 20th the digital spending on education was \$227 billion, and it is forecasted to be \$404 billion by 2025 [5]. Problem-based learning (PBL) emerges from discussions on the centrality of problem-solving in all aspects of everyday life and the need for education to go beyond the transmission of knowledge which often graduates find difficult to apply to new contexts and at the workplace [6]. In PBL contexts, learners solve problems in collaboration with peers as part of a self-directed learning approach. In that respect, responsibility for learning shifts toward the learner and/or the group of learners [7]. In PBL, knowledge and skills are organized around authentic problems which are often ill-structured rather than being organized around a hierarchical list of topics. As such, knowledge building in PBL approaches is stimulated by the problem, applied back to it, and structured around it [8], [9].

Simulation-based learning places students in situations where they can put their classroom knowledge into practice. Educational simulation is a teaching method that tests participants' knowledge and skill levels by placing them in scenarios where they must actively solve problems. The instructor defines the parameters to create a safe environment for hands-on learning experiences. A simulation is a form of experiential learning [10]. It is a strategy that fits well with the principles of student-centered and constructivist learning and teaching; that is, learning and teaching that gives students power over what they learn and how they learn it, and that allows students to build their understanding of what they're learning through their experiences and interactions, rather than just passively receiving information [11].

By promoting direct participation of students in their knowledge building, simulation-based education (SE) incentives intrinsic motivation in the hands-on learning activities designed by the instructors and developed under their supervision and guidance. Learning practices based on the use of SE software, tools, and games are receiving the attention of academic and industrial partners, who see SE as a way to improve the training of their students and future employees [12]. When participating in a scenario, students must quickly evaluate the situation, decide on the best course of action, and perform the correct procedural

steps. Educators can then assess whether the students understand the material and are translating their learned knowledge into skills.

II. DATA IS NEW OIL

The most useful resource of the 21st century is data. Data mean to the digital economy the same as oil meant to the industrial economy. But what is important to take into consideration, just data itself has no value. It needs to be mined and analyzed and just after this, it creates value [13]. Various types of information can be extracted from data because it promises an endless number of new uses, i.e. diagnosis of diseases, the direction of traffic patterns, estimation of customer behavior, economic forecasts, etc. But to achieve these outcomes, a lot of work in data science, engineering, and data interpretation is needed. The five most valuable companies (Apple, Amazon, Facebook, Microsoft, and Google) dominated their sector mainly thanks to the sale of access to data. At the same time, they collect information about every aspect of our lives and this data gives them more profit and power. Thanks to a huge mass of data every metric of business can be tested, measured, and improved [13]. The Global Sentiment Survey 2023 explored that due to the launching of the ChatGPT the AI and data analysis trends are back [14]. This leads to a constant need in the labor market for people who are oriented and have experience in this field.

III. IMPLEMENTING DATA ANALYSIS TOPICS INTO EDUCATION

The Faculty of Economics tries to provide up-to-date education to follow the marketplace expectations on higher education graduates. That is why that list of mandatory courses is continuously supplemented by the courses that cover the newest trends in the real world. One of the topics which we implement wider is data analysis and data visualization. That was the purpose of designing new optional courses (i.e. Introduction to R Statistics, Data Analysis and Reporting, Introduction to Datamining, Selected models and analyses in banking, Data Analysis and visualization) that create data analysis learning path across the whole study at the faculty. These courses develop students' skills and follow on from compulsory subjects such as Informatics I, Informatics II, Statistics and Probability, and Statistical Methods in Economics. Our objective is not only to acquaint students with the basic terminology in the field of data analysis but also through practical tasks to ensure the acquisition of skills in the use of data preprocessing methods as well as the subsequent use of methods of analysis and self-paced learning, data visualization on specific problems created by everyday practice. Following we describe in more detail our experience with the brand new course Data Analysis and Reporting.

This course is taught in the bachelor's degree of study branch Finance, Banking and Investment and can be chosen by students who have completed the compulsory subjects Informatics I and Informatics II, where they were introduced to programming in the environment of the R language, basic functionalities of MS Excel application, introduction into information systems and databases. Previously listed form the basis for the optional course,

where students are gradually introduced to various business intelligence tools and methods that are used in practice in the analysis and subsequent interpretation of data. The course is focused on solving problems through various models and methods of data analysis on real business data.

The first run of the course was realized during the winter semester of the academic year 2022/2023. Because the course is optional, it is usual that a new course arouses little interest among students, especially if it is a subject connected with information technologies. So this first run was attended by 8 students who are interested in data science. The content covers the topics like introduction to data analysis, obtaining data from external sources, data pre-processing, detection of basic characteristics, and detection of anomalies and outliers.

These topics were divided into 13 face-to-face lectures, supported by an online course in LMS Moodle, where students can find a lot of additional information sources, best practices connected to the discussed topic, and more exercises to become more skilled in the field of data analysis and reporting, design, and development of simple or more complex visualization in MS Power BI application and interpretation of data. During the face-to-face lessons, we practically get across the whole data analysis process using anonymized real enterprise data, that are prepared for us by the company Deutsche Telekom IT Solutions Slovakia (DT). Cooperation with this company already started about five years ago, when employees of the Finance and Controlling Department participated in lectures concerned on the MS Excel application used in the DT company. This cooperation inspired us to involve more in the practical education of our students. Within the course, the DT employees actively participated in the design of the course, had lecturers with presenting the real connections to data saved in DT information systems, and following operations usually done in their daily routine, prepared and evaluated the semestral project.

The semestral project was fully covered by colleagues from the DT company and it was designed like an assignment of a project with which employees in the Financial Controlling department meet daily. The students had at their disposal dates, a short description of expected outcomes, delivery dates and a request in which way and in what form the performances should be submitted. The main idea was to prepare a report with financial results for the last 2 years. Students are in the role of Chief Business Analyst and they need to prepare a report for the CFO of the DT company to better understand the situation with the realized projects for the clients. The final solution was expected to be an application prepared for summary & detailed data analysis of your data set which needs to be visually attractive, cover all mentioned topics, and be ready to present to the CFO of the company.

The main objective of the implementation of the semestral project was to develop the practical skills and competencies of students and also enhance students to think and act more independently without intervention or instructional guidance by the teacher. For the students it was a new experience also of the amount of data that they

have to face, the dataset contained about 50 000 rows and 10 attributes for the years 2020 and 2021 and to solve the task students need also the search for missing information on the Internet. There was no right or accurate solution set in advance, so they need to be also creative in the design of visualization (Fig. 1) and following presentation of the achieved results (Fig. 2).

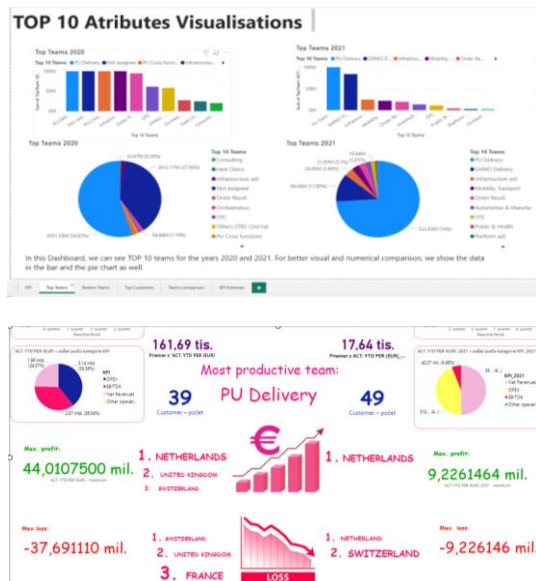


Figure 1. Examples of students' results; Source: own contribution



Figure 2. Final presentations of semestral projects; source: own contribution

The course evaluation is divided into two parts:

- practical credit exam (40 points of final available 100 points) that is aimed more at checking practical skills of working with data, their pre-processing, and subsequent visualization through the MS Power BI application.
- semestral project (60 points of final available 100 points) that is aimed more at the individual work of students and is described in more detail above.

Participating students surprised us. Over 75% of students achieved results better than 81 points in the final evaluation (82 points on average). They were able to prove their knowledge in working with the application used for pre-processing and working with data. The average result achieved for the credit exam was 32.63 points. The positive information is that our students achieved pretty good evaluations for their work on the semestral project which was evaluated by the DT employees according to the same criteria as the success of the delivery of the expected product would be evaluated in practice. They achieved 49.38 points from a maximum of 60 points. Particular results in more detail are presented in Table 1.

TABLE I. ACHIEVED RESULTS OF STUDENTS (IN THE PERCENTAGE OF THE GROUP OF ALL STUDENTS)

Success interval	Evaluation parts		
	Credit exam	Semestral project	Final result
91 – 100pt	25.00%	12.5%	25.00%
81 – 90pt	0.00%	62.5%	50.00%
71 – 80pt	62.5%	0.00%	12.50%
61 – 70pt	12.50%	25.00%	12.50%
51 – 61pt	0.00%	0.00%	0.00%

Source: own contribution

In general, based on the achieved final point results we can state, that course is well-designed and the main objectives are fulfilled. Besides the points, education has other associate effects and benefits:

- achievement of hard and soft skills that are required by the future employers of the students. This represents a significant benefit when looking for a job.
- getting an idea of how employees receive assignments in practice, what conditions they have to meet, and how they are evaluated in the end. This kind of achievement is slightly different from those they already have in their past; they can fulfil different criteria that are set usually by the teacher that follows the accreditation rules.
- get experience to present achieved results in to present and defend the method of data interpretation for people knowledgeable in the given field, who followed not only the "colors" of the presentation but also the complexity and meaning of the offered solution.
- and finally, the best three semestral projects get the DT gift thing and an offer to spend one day in the so-called shadow in their company, where they will have the opportunity to see how it works in practice, which can be followed by a part-time work offer.

The final evaluation points are just one side of the education process. Because the course realization was first run (and for the people from DT also first experience in cooperation such kind of course) of the course like this we were curious about the students' opinion. After passing the course we asked students to answer feedback to reach a better quality of data analysis education, to enhance

students' interest and motivation to study this topic. The feedback contained 77 questions and can be divided into the following parts:

- the reasons why they choose this course,
- course organization and published information,
- semestral project,
- course content and content of particular chapters,
- the way of evaluation of course
- and their opinion on the DT employees' participation in the education process.

As was mentioned above, the course was attended by 8 students, so the achieved results cannot be generalized, but we achieved the opinion of every student, which is why we decided to take it into account and prepare the next run better. After summarizing the answers, it is possible to mention the most interesting and important outcomes connected to specific parts of the feedback.

A. The reasons why they choose this course

The most frequently occurring reasons were the possibility of acquiring additional skills that students could use in the future in practice, as well as their awareness of the importance of knowledge in the field of data processing. An interesting reason, that was also mentioned, was a teacher with whom they already had positive experiences in the past.

B. Course organization and published information

The subject as a whole was evaluated with an average grade of 4.25 out of 5. Table 2 represents students' answers with assessments concerning the subject as a whole. Students would appreciate more practical exercises, which also supports the opinion that the number of hours per week in the given subject should be increased, with 62.5% of students proposing to increase the time span of the subject by at least 1-2 hours per week.

TABLE II. STUDENTS' SATISFACTION WITH THE COURSE ORGANIZATION AND PUBLISHED INFORMATION

Criteria	Percentage of chosen answers				
	<i>Very satisfied</i>	<i>Satisfied</i>	<i>Neither satisfied nor dissatisfied</i>	<i>Dissatisfied</i>	<i>Very dissatisfied</i>
Clarity of course organization	37.5	62.5	0.0	0.0	0.0
Amount of published information	50.0	37.5	12.5	0.0	0.0
The way of course realization	37.5	62.5	0.0	0.0	0.0
The proportion of theory vs. practice	25.0	37.5	0.0	37.5	0.0
Hourly subsidy for the subject per week	12.5	12.5	12.5	37.5	25.0

Source: own contribution

C. Course content and content of particular chapters

Over 87.5% of students stated that the published information inspired them to continue working with data in the future. As part of the feedback, we analyzed all parts of the content of the subject in detail (i.e. individual chapters of the subject, however, due to the scope of the contribution, it is not possible to present the obtained results to a broader extent). Each chapter of the subject was divided into the theoretical background, practical tasks, and additional study material. Students evaluated each of these components separately from several aspects (see Table 3).

TABLE III. STUDENTS' SATISFACTION WITH THE SEMESTRAL PROJECT

Criteria	Percentage of chosen answers				
	<i>Very satisfied</i>	<i>Satisfied</i>	<i>Neither satisfied nor dissatisfied</i>	<i>Dissatisfied</i>	<i>Very dissatisfied</i>
Clarity of SP organization	37.5	25.0	25.0	12.5	0.0
Amount of published information	50.0	25.0	12.5	12.5	0.0
The difficulty of SP (the project was not so difficult)	12.5	25.0	25.0	37.5	0.0
Way of evaluation	37.5	25.0	25.0	12.5	0.0
Way of realization	12.5	75.0	12.5	0.0	0.0

Source: own contribution

In the context of practical preparation and strengthening of the student's independence in the study process, we were also interested in whether they tried to do the tasks independently at home, although this activity was not evaluated. Almost 87.5% of students confirmed to us that the topic interested them and they tried to do the assignment independently, and 62.5% of students did not have a problem with the given tasks during homework. If there was a problem, all respondents confirmed that they solved it as part of a team with colleagues.

D. Semestral project

As part of the semester project, students could try out how projects are handled in an IT company. They could also evaluate this time of the subject, and we were interested in several aspects since this assignment was fully organized by the employees of DT. The results are presented in Table 4.

E. The way of evaluation of course

As already mentioned, the evaluation of the subject was divided into two parts - a report card and a semester project. The first thing we were interested in was whether they considered the distribution of points in the ratio of 40/60 to be fair. From the point of view of the students, this division is surprisingly unfair for some, they would accept more points for the credit report (25%), some students (25%) cannot decide and 50% are satisfied with the current setting.

TABLE IV. STUDENTS' EVALUATION OF THE COURSE CONTENT

Content criteria	Percentage of chosen answers				
	Very good	Good	Acceptable	Poor	Very poor
Quality of theory	75.0	12.5	12.5	0.0	0.0
Quality of supplementary study material	75.0	12.5	12.5	0.0	0.0
The proportion of theory vs. practice	50.0	25.0	25.0	0.0	0.0
Method of providing information	75.0	12.5	12.5	0.0	0.0
Difficulty in understanding the presented information	50.0	25.0	12.5	12.5	0.0
The difficulty of practical exercises	25.0	50.0	12.5	12.5	0.0
Supporting understanding of the topic through practical tasks	62.5	25.0	12.5	0.0	0.0

Source: own contribution

Most of the students rated credit written test as undemanding (Fig. 3).

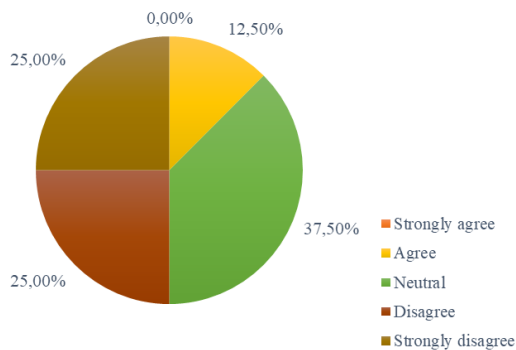


Figure 3. Rate of agreement with statement: "The credit test was demanding"

F. DT employees' participation in the education process

An important part of the course was the cooperation with external colleagues from practice. That is why we and they were interested in how the students perceived this kind of participation in the subject. The students evaluated several aspects of cooperation, including the level and implementation of presentations as well as the impact of such participation on their motivation to continue studying. Table 5 presents the resulting findings.

After completing the subject, they also identified the added value of the given subject as an insight into the environment of data analysts, they improved in working with applications such as MS Excel, MS Power BI, and MS PowerQuery, cooperation with a real company, sharing knowledge with practice and the possibility to solve problems completely independently a problem.

IV. CHALLENGES FOR THE FUTURE

Whenever we implement a new education method or realize a new course, we analyze the course from different points of view: the content, way of organization and realization, and level of achieved learning objectives. The course is analyzed and evaluated by the teacher, external partners, and by students. The evaluation process helps us identify the challenges for further improvement and set of actions how to fulfil them. Based on our current experience, the results of feedback from the students, and discussions with the employees of DT Slovakia, we identified several challenges for the future implementation of the given subject:

- *lack of time allocated for face-to-face learning.* In the current academic year, we incorrectly set the hourly subsidy for the subject. Many times we also discussed the topic with the students during the lectures, but there was not enough time for practical training or checking our conclusions from the discussion. It is, therefore, necessary to at least double the weekly one-hour subsidy for the subject.
- *The ratio of lectures and exercises.* This challenge is connected to the first one. Students would like to have more practical exercises with instructions for working with data since they have never worked with such large data before. This challenge could be fulfilled together with the first challenge.
- *semestral project realization and evaluation.* SP was evaluated by both parties as profitable, but in the future, it will not be appropriate to motivate students to solve SP points for individual partial tasks, because they often immersed themselves only in solving these tasks and underestimated the more complex interpretation of data in a wider context. In addition, the point evaluation weighed the students' hands in their creativity. In the future, it would be more appropriate to set up a friendlier environment, so that the student does not fear that for the incorrect presentation of data, they may lose points, which are transferred to the final evaluation. In addition, to improve the project and to test the students'

TABLE V. STUDENTS' OPINION ON THE PARTICIPATION OF DT EMPLOYEES IN THE EDUCATION PROCESS

Criteria/Statement	Percentage of chosen answers				
	Absolutely agree	Agree	Neutral	Disagree	Absolutely disagree
Participation in DT is beneficial for the education	62.5	37.5	0.0	0.0	0.0
Employees' approach was sufficient	62.5	37.5	0.0	0.0	0.0
Employees' approach was motivating	50.0	25.0	25.0	0.0	0.0
Lectures were captivating	75.0	25.0	0.0	0.0	0.0
Lectures had accurate proportion theory and practice	62.5	12.5	12.5	12.5	0.0

Source: own contribution

performance in practical life, it is possible to use the SCRUM methodology during the semester project, where students can try different roles, at the same time they will have to work regularly and report the results and thanks to the meetings after the sprints they will also get instant feedback on their work in the time when solving individual tasks.

- *lack of students in the course.* During the first run, the course was attended just by 8 students. That is why it is necessary to think of some way to promote the optional Data Analysis learning path in the compulsory courses and thus attract more students to the field. We have some ideas on how to motivate younger students, for example presenting the performances of colleagues from the course during lectures of their younger colleagues and possible future attendants; pointing out that this course is practical for their future work or development in this direction, as unlike other optional courses, where they could work with something that is used in practice; preparation of promotion activities in cooperation with DT; short promotion video prepared by students that they passed the course.

V. CONCLUSION

After processing the feedback on the course from the students, we got several interesting statements, such as the fact that 75% of the students agreed that better participation in the lessons would be helpful if the students would explain things to each other. All students confirmed that they consider the course realized in this way to be very beneficial for their future life. Thanks to passing the course, they could try out the way of working in a real company in a safe environment and the wide possibilities of working with data. The interesting outcome was that even though educational theory states that when using simulation-based learning it is important to have clearly defined assessment criteria, our students were in a sense less creative and more focused on the assessment they could get for completing individual tasks.

In the paper, we presented a positive confirmation of the fact that students are more interested in education if we continuously ask for their opinion if we add a huge part of the practice. Using an accurate mixture of it, we will reach a win-win situation. Thanks to the cooperation with practice and the simulation of real life in the company, we get motivated students who have the skills necessary for practice with an interest in dealing with the given field in the future. This was also confirmed by the students' interest in further cooperation within the framework of bachelor's theses focused on the field of data analysis. And last but not least, companies that cooperate in the education process also benefit, because, in the framework of cooperation, they can point out their requirements for future employees.

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