

DUCK project

KA2 Strategic Partnerships – 2018-1-HU01-KA202-047809

NEEDS ANALYSIS, BEST PRACTICES AND TOOLKIT REPORT

*Collated results from the country reports from Hungary,
Iceland, Spain and Poland*



Image: Freepik.com

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INTRODUCTION

1.1 THE PROJECT AND IO1

The DUCK project aims to develop **online training modules on Data Understanding and Communication** to be implemented in CPD, VET and HE environments **to develop the skills of teachers and trainers (and their students) of analyzing and presenting data**, enriching their teaching practices and employability.

It is organised in different Intellectual Outcomes which operate in the project as building blocks. This report is part of IO1 *Needs Analysis and Best Practices of Data Understanding and Communication* which aims at the production of needs analysis, best practices and toolkit report regarding data understanding and communication for teachers and trainers further education.

1.2 AIMS OF THIS REPORT

This study aims to **map the state-of-the-art in data understanding and communication teaching methods in the consortium partner countries and at EU level.**

The **findings will feed into the Data Understanding and Communication (DUC, from now on) course (O2), development of sector specific activities and examples (O3), Lessons Learned Kit (LLKit from now on) and guidelines (O4) and the on-line resource center and learning portal (O5).**

1.3 PARTICIPANTS AND METHODOLOGY

The activities leading to the elaboration of this report were implemented from November 2018 until September 2019. They were implemented by teams in the partner countries in ICELAND, Hungary, Spain and Poland.

This report follows the instructions of the “*DUCK O1 Overall Methodology*” planning document. In this frame, a specific desk and field research was implemented in the 4 countries involved:

Desk research involved the review of national and regional legislation and state of the art report included in chapter one: desk research.

Field research involved the implementation of interviews, online survey and focus groups that are included in chapters 2, 3 and 4 of this report.

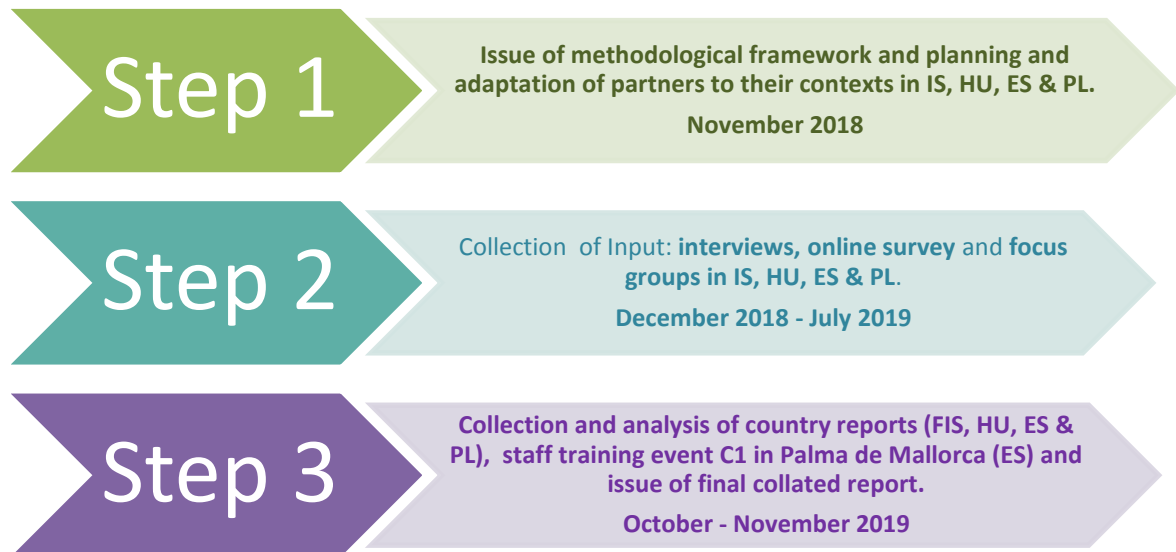


The participants in the field research activities were:

COUNTRY	INTERVIEWS	SURVEY	FOCUS GROUPS
ICELAND	3 expert trainers in the field of DUC	11 teachers and trainers which reported their expertise to better understand their needs regarding DUC issues in their classes	4 experts, teachers and trainers that debated the former results from Interviews and survey and proposed practices
HUNGARY	5 expert trainers in the field of DUC	24 teachers and trainers which reported their expertise to better understand their needs regarding DUC issues in their classes, and 10 managers from the industry who are also responsible for the training of their subordinates.	7 experts, teachers and trainers that debated the former results from Interviews and survey and proposed practices
SPAIN	3 expert trainers in the field of DUC	30 teachers and trainers which reported their expertise to better understand their needs regarding DUC issues in their classes	8 experts, teachers and trainers that debated the former results from Interviews and survey and proposed practices
POLAND	3 trainers interested in the field of DUC	30 teachers and trainers which reported their expertise to better understand their needs regarding DUC issues in their classes	8 experts, teachers and trainers that debated the former results from Interviews and survey and proposed practices



The methodology followed included the following steps:



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2. DESK RESEARCH: KEY QUESTIONS COVERED BY LITERATURE REVIEW

2.1 POLICIES

ICELAND

Teaching of Data Understanding and related subjects, on VET, HE and CPD level, is not explicitly governed in Icelandic legislation. Courses that are part of an accredited 3rd level Higher Education degree fall under Law nr.62/2006 on universities¹ [Footnote refers to citation], and Icelandic universities are monitored and evaluated on a regular basis under the Quality Enhancement Framework for Higher Education in Iceland².

In Iceland, a law on Adult education was passed in 2010 and set a framework for, among other things, accreditation of courses and modules that are meant to enhance skills and abilities of employed persons in response to the needs of the economy.³ Accredited diplomas or courses for Continuous Professional Development (CPD) fall under this category. The Education and Training Service Centre (ETSC) is a unit that accredits curricula for adult education in Iceland. The ETSC is owned by the Icelandic Confederation of Labour (ASÍ), the Confederation of Icelandic Employers (SA), the Federation of State and Municipal Employees (BSRB), the Ministry of Finance and the Association of Local Authorities in Iceland. In connection with the collective wage agreement between ASI and SA in 2002, the Icelandic government issued a statement of intent which led to the establishment of FA. Operation began in 2003.

The aim of the Adult Education Act is to „meet the needs of adults with short formal education and also to meet the needs of the labour market for staff with increased knowledge and skills. On the basis of the Adult Education Act, studies outside upper secondary schools and universities will have increased weight.“ The ETSC administers The Education Fund, which is financed by the state budget, and supports teaching, counselling and validation by accredited educational providers and development of new curricula.⁴

HUNGARY

There are no specific policies related to training or upskilling for teachers, trainers and university professors regarding specifically data understanding and communication in Hungary. Statistics courses are part of all higher education learning provisions as either mandatory or voluntary courses, depending on the major, thus you can acquire your training without a mandatory course in statistics.

There are 3 legal documents affecting the curriculum of VET and HE education. These are the *Act on National Higher Education*, the *Act on Vocational Education and Training* (including the National Register of Vocational Qualifications) and the *Adult Education Act*.

¹ <https://www.althingi.is/lagas/nuna/2006063.html>

² <https://en.rannis.is/activities/quality-enhancement-framework/>

³ <https://www.althingi.is/lagas/nuna/2010027.html>

⁴ <http://frae.is/um-fa/about-us/>



As education provision is mainly public, the top down policy approach is also strong. It is headed by the Educational Authority (former Ministry of Education). For the present report all these documents were researched in relation to data understanding, data sciences and critical thinking.

As stated at the beginning, no specific policies can be found regarding data understanding in the above legal documents and their follow ups. Data scientist (per se) is not present in the National Register of Vocational Qualifications. However, the qualification of statistician is there with several sub-fields. Adult education companies are more flexible in following the needs of the industry and offer several courses in data science.

In the communication of the educational field of the government, data science is not present or highlighted, the focus is on STEM fields in general. In the last years there were no state funded programs targeting or highlighting data understanding and/or critical thinking .

SPAIN

There are no specific policies related to training or up skilling for teachers, trainers and university professors regarding specifically data understanding and communication in Spain.

We may focus on Continuing Professional Development (CPD) as it is the field where, in Spain, we may place the DUCK course.

POLICY INTRODUCTION: Continuing professional development of teachers and professors in Spain is both a right and a duty of all teachers. The education authorities are responsible for planning, organising and recognising continuing professional development within their jurisdiction providing teachers with a wide range of activities. Continuing professional development activities consist of regular actions for the updating of their scientific, educational and professional expertise. Participation is voluntary. Priority guidelines for 2018 (Ministry of Education Culture and Sports, 2018) on continuing teacher training plans are annually established through the Spanish Institute for Education Technologies and Teacher Training (INTEF):

1. Multiple literacies
2. Teachers' digital competence
3. Sense of initiative and entrepreneurship
4. Foreign languages
5. Inclusion and attention to students' diversity
6. School coexistence
7. Scientific culture
8. Management skills: leadership oriented to the educational success of all students
9. Education inspection
10. School healthy lifestyles
11. Neuroscience applied to education



POLAND

The review of the education policy included an analysis of selected legal acts in the field of vocational education, higher education and the implementation of the European Qualification Framework in Poland. In the country, there are in force the Polish Qualifications Framework and the Integrated Qualification System, and universities are required to assign qualifications levels to study programs at three levels and postgraduate studies (Dz.U. 2018 poz. 1668, 2018, s. Art.28, ust.15).

In the field of documentation of learning outcomes, i.e.: knowledge, skills and competences, the effects associated with critical thinking are present. It is assumed that the graduate has the skills of critical thinking at Level 6 (BSC, Eng.) and Level 7 (Master), which corresponds to European Qualification Framework. Examples of learning outcomes along with detailed comments on technical universities are described in (Macukow, 2011). This proves that it is assumed that the realisation of the higher education program by student is to lead to the development of its skills and competencies requiring critical thinking or, more broadly, criticism in relation to the analyzed content and the tasks carried out.

There are compulsory subjects in the area of formal logic in law faculties, sociology, and computer science. Numerous training materials, textbooks, presentations are available. We found book publications about critical thinking (Kisielewicz, 2017; Biecek, 2016; Kisielewicz, 2017), literature in the field of argumentation is also available and extensive (Kisielewicz, 2017; Tokarz, 2006; Szymanek, 2004, 2001).

In the field of vocational education, we did not find any guidance on the competences of critical thinking (Dz.U. 2019 poz. 316, 2019). The emphasis is on strictly professional qualifications.



1.1 PRACTICES AND TEACHER LEARNING OPPORTUNITIES

This part of the desk research covers 2 issues:

1. Availability of DUC subjects in VET or HE
2. Availability of DUC education or further education courses for teachers in HE (and if there is online education available)

We will present the results below by country.

ICELAND

Continuing Education University of Iceland⁵ is the biggest provider of continuing education courses in Iceland and offers a wide range of courses and study programs. By a review of the course offering, four courses were identified, that specifically covered communication of quantitative data. Three of them, were courses in using Microsoft Excel, at incremental levels of complexity, while the fourth was a course on Microsoft Power BI:

- Excel - First steps (IS. Excel – fyrstu skrefin)
- Excel - Basics and key operations (IS. Excel – grunnatriði og helstu aðgerðir)
- Excel - Complex operations for advanced users (IS. Excel – flóknari aðgerðir fyrir lengra komna)
- Microsoft Power BI

Reykjavík University runs The Open University, and as described on their homepage, the aim is to increase skills and abilities of professionals in various fields

„Longer-term study programme at The Open University of RU varies from one semester to one year and is suitable for parallel work. The main objective of longer courses is to give participants recognition in their profession and increase their knowledge and skills within a specific field.“⁶

From their course offering, four courses were identified that involved training in Data Understanding and Communication. These were:

- R – Statistical Analysis (IS R – tölfræðiúrvinnsla)
- Pivot Tables and Graphs – Excel (IS Pivot töflur og gröf – Excel)
- Data processing and Analysis (IS Vinnsla og greining gagna)
- Power BI - Reports and Dashboards (IS Power BI – skýrslur og mælaborð)

Within the Icelandic university system, two universities have Faculties of Education. These are the University of Iceland and the University of Akureyri. Both offer Bachelor and Master level studies in addition to various Diplomas.

To teach at the upper-secondary level in Iceland, candidates holding a Master's degree or higher in their field on specification, must complete an additional 60 ECTS diploma in Pedagogy. One notable (elective) course within that curriculum is ICT for Education and School Development (IS. SNU007F

⁵ <https://en.endurmenntun.is/about>

⁶ <https://oh.ru.is/english>

Upplýsingatækni í menntun og skólaþróun) which includes the use of ICT to gather and analyse data as one of the competences acquired by its students. But there is no explicit unit found in the curriculum, focusing exclusively on Data Communication.

HUNGARY

✓ Availability of DUC subjects in VET or HE

In Hungary there are courses that teach qualitative and quantitative methodologies: probability theory, statistical uncertainty, randomness are part of courses like technical management. Besides this HE has general statistics in Quality management and business statistics programmes: there are 14 BSc programs and 6 MSc programs. Quantitative statistics are taught in average 4 classes per week, qualitative analyses belong to the quality management classes.

The Educational Authority employees at present attend a course on data visualisation, using Power BI by Microsoft that is the most widespread app for data visualisation, usually used by the industry. Relatively easy to use, with easy data filtration. Their course (50 hours) however was open only to people with a specific background (analysts, colleagues working with big data, ICT people). Presentations and teamwork worked well; however data manipulation was taught using Data Analysis Expressions (dax), and as this is not the formula that the Authority use, it was a waste of time and people got demotivated.

The National Széchényi Library has CPD for librarians, a very long course. Parts of it introduce them to databases that they will receive and teaches them to understand it.

✓ Availability of DUC education or further education courses for teachers in HE (and if there is online education available)

There are no courses specifically aimed at HE teachers. There are some workshops in higher education that deal with DUC, e.g. University of Szeged has these workshops in its PhD programs. However the aim is to teach students to come up with new research topics and not to use existing data. This is a mistake, as this is a much rarer skill than organising a new research data collection. The later is basically the recipe for them to come up with a research aim that is already covered or such a small scale that has very little relevance. It would be much better if they could learn how to understand and analyse data.

The Hungarian Institute for Educational Research and Development might have some handouts on DUC, and there is also a book that is widely used on research methodology, but neither is offered as a CPD course for educators.

SPAIN

✓ Availability of DUC subjects in VET or HE

VET: data understanding and communication is specifically dealt with under “Computing and Communications iVET” which has 2 Certificates:

- Basic Vocational Training Certificate in Desktop Computing
- Basic Vocational Training Certificate in Computing and Communications

The second one has 2 modules named “Communication and Society I and II.” Taking a look at the IES ALQUIBLA didactic programming of Communication and Society II we can see that the module outline includes the objective *“Develop skills to formulate, pose, interpret and solve problems applying mathematical reasoning and calculation to be able to live in society, in the environment labor and manage their economic resources”* (IES ALQUIBLA. 2017-18). However, the contents of the units are very much linked to basic language and oral communication skills.

HE: There are plenty of communication related subjects that deal with Data Understanding and Communication in both bachelor and master’s degrees in Spain.

- Bachelor: if we go to bachelorsportal.com and look for communication sciences, we are able to find 16 degrees in Spain that deal with communication;
- Master: if we go to mastersportal.com and look for communication sciences, we are able to find 23 master courses dealing with it.

✓ **Availability of DUC education or further education courses for teachers in HE**

Courses for teachers and professors in Spain are issued both at national level (i.e.: Ministry of education: for primary and secondary education teachers:

<http://www.educacionyfp.gob.es/mecd/servicios-al-ciudadano-mecd/catalogo/general/educacion/201533/ficha.html>) plus the specific offers of the autonomous communities (example from Andalusia:

<http://www.juntadeandalucia.es/educacion/portals/web/ced/actividades-formativas>)and can be followed both face to face and online, depending on the course. We have not been able to find any course dealing with Data Understanding and Communication even though many of them do provide upskilling of use of ICT for learning.

There are also plenty of courses for university professors offered by the Universities internal upskilling plans but we have not been able to find any focusing specifically on Data Understanding and Communication.

As to **online courses**, there are opportunities for informal learning, that is, courses over the internet that can be followed by teachers, trainers and students focusing on Data Understanding and Communication, as examples:

- Analista De Datos Big Data (BIG DATA ANALYST) – CLOUDERA.
<https://www.emagister.com/analista-datos-big-data-cloudera-cursos-3418375.htm> Free.
- TABLAS DINÁMICAS Y ANÁLISIS DE DATOS E HIPÓTESIS CON EXCEL (DYNAMIC TABLES AND DATA ANALYSIS AND HYPOTHESIS WITH EXCEL) : <https://www.udemy.com/analisis-de-datos-e-hipotesis-con-excel-2013/>. It costs 10,99€
- Programa Especializado Análisis de Datos Para la Toma de Decisiones (SPECIALIZED DATA ANALYSIS PROGRAM FOR DECISION-MAKING)
<https://www.coursera.org/specializations/analysis-datos>. It does not include price and you can freely participate as a listener.

POLAND

✓ Availability of DUC subjects in VET or HE

In the area of vocational education and higher education a course with a title including the topic of data and communication could not be found. On the other hand, the competences directly related to the understanding of data and the presentation skills are realized during the course of studies, generally as separate subjects or their parts. Samples:

- Warsaw University of Technology: Engineering and data analysis⁷.
- Warsaw University of Technology, Faculty of Management: Business Invention.
- AGH University of Science and Technology, elective subject: Critical thinking. Contemporary challenges of culture and civilization⁸.
- AGH University of Science and Technology: Advanced data analysis methods⁹.

In addition to the above examples, one should include subjects from formal logic, compulsory during legal studies, computer science and mathematics.

In the field of CPD the educational offer in the field of data analysis and presentation offered either by training companies and universities (e.g. Cognito¹⁰, PARP Academy - Polish Agency for Enterprise Development¹¹, Kozminski University¹²) is rich and varied in terms of content and level.

⁷ <https://www2.mini.pw.edu.pl/studia/inzynierskie-i-licencjackie/inzynieria-i-analiza-danych/>

⁸ https://syllabuskrk.agh.edu.pl/2018-2019/pl/magnesite/study_plans/stacjonarne-fizyka-techniczna-4/module/jft-2-219-s-letni-myslenie-krytyczne-wspolczesne-wyzwania-kultury-i-cywilizacji

⁹ https://syllabuskrk.agh.edu.pl/2016-2017/pl/magnesite/study_plans/stacjonarne-socjologia-multimedia-i-komunikacja-spoleczna/module/hso-2-205-mk-s-zaawansowane-metody-analzy-danych

¹⁰ <https://www.cognito.pl/kursy-analiza-i-wizualizacja-danych.s.450.html>

¹¹ E.g.: Data analysis and presentation in Excel, Power Point, Prezi: <https://uslugirozwojowe.parp.gov.pl/uslugi/view?id=140518>

¹² Presentation, analysis and transformation of data using the MS Excel spreadsheet <https://www.kozminski.edu.pl/pl/oferta-edukacyjna/kursy-i-szkolenia/wspolne-elementy-kursy-i-szkolenia/finanse/prezentacja-analiza-i-przekształcanie-danych-z-wykorzystaniem-arkusza-ms-excel-warsztaty-komputerowe/>; Critical thinking - the key competence of the 21st century leader <https://www.kozminski.edu.pl/pl/oferta-edukacyjna/kursy-i-szkolenia/kierunki/krytyczne-myslenie-kluczowa-kompetencja-lidera-xxi-wieku/o-kursie/>

✓ Availability of DUC education or further education courses for teachers in HE (and if there is online education available)

Based on the review of websites of universities and training companies, we must admit that we have not found a course linking both elements: data understanding and communication. In general, separate courses on data presentation are conducted, e.g. as part of a compulsory pedagogical study for PhD students.

As to the understanding of data - it seems that the analytical approach to data dominates. Synthesis, inference and interpretation are a part of the programs of courses or training previously indicated as examples.

As to online courses, the company, namely TOC dla Edukacji Ltd. Offer, on a commercial rule, a variety of educational activities related with data understanding and communication, addressed, among others to teachers. The example of the company and its offer is described in detail in the next section as an example of good practice.



1.2 GOOD PRACTICES

1.2.1 HUNGARY

GOOD PRACTICE #1: Open Data Science Course in BME

NAME OF THE GOOD PRACTICE:	Nyitott Data Science órák a Műegyetemen
Type of good practice (Training Programme, Teacher Training, Handbook/Guidelines, Online Tool / learning Platform, etc.).	Classic Face to face class
Description of the identified good practice	A one semester masters level open course 2 classes/week
Short description of the main aims, methodology and delivery method	The main aim is that the students may formulate data mining tasks and are able to solve them in order to reveal hidden relations between data in a large cohort. The techniques to use to solve those problems are not only data mining, but machine learning, and data analysis theoretical background will be explored. Different programming platforms will be presented. The exercises will be done on real data covering migration forecast, marketing campaigns, risk forecast.
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	Real data sets, topics, and data analysis theory could be transferable. Further transferable topics: customer clustering, data transformation visual analysis, data preparation by: filtering and integration, transformation.
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	This course is addressing different types of learners, but on an MSc level in programming. Otherwise different sectors from business, banking, marketing, campaigning. Different segments use different data sets, and the problem formulation may be different, but the solving techniques are similar.
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented.	Unfortunately apart from a very detailed description of the methods, and topics, aims and examples, prerequisites and timing, the content itself is not accessible from the site.
Further comments	The description of this course also refers other Big data trainings in Hungary.



GOOD PRACTICE #2: Kurt Academy: Data Science

NAME OF THE GOOD PRACTICE: KÜRT AKADEMIA: DATA SCIENCE	
Type of good practice (Training Programme, Teacher Training, Handbook/Guidelines, Online Tool / learning Platform, etc.).	Classic face to face in-service adult training
Description of the identified good practice	<p>This is an adult learning course in the framework of Kürt Academy. Kürt is the best known company in the field of recovering data from damaged hard disks and streamers.</p> <p>The course invites business professionals and specialists who are interested in finding answers that the jungle of data may handle and understand data, and who want to understand the synergies and relations between business needs and technological solutions</p>
Short description of the main aims, methodology and delivery method	<p>The main aim of this Data science course is to give an introduction to the world of data, collecting, storing and processing.</p> <p>To give a pathway from statistical basics to model making with analytical methods.</p> <p>Introduction to advanced analytics and big data tools.</p> <p>Introduction to the legal aspects of data handling</p> <p>Connecting data with people: Data visualisation and communication.</p> <p>90 hours, 2 semester, Over 1 million HUF</p>
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	<p>Not really. But it is reinforcing the strategy of DUCK as the main thematic is more or less the same.</p> <p>A real discovery that this course is dealing with the legal aspects of data handling that should be included in DUCK as well.</p>
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	Yes, this is a course that is offered to different type of people coming from business either data scientists, or only interested in this rapidly emerging field. Therefore only basic excel knowledge and basic coding experience in python is suggested, otherwise everything is explained during the course.
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented	No, unfortunately not open.
Further comments	N/A



1.2.2 ICELAND

GOOD PRACTICE #1: Statistical Consulting Center at the School of Health Sciences, University of Iceland

NAME OF THE GOOD PRACTICE:	The Statistical Consulting Center at the School of Health Sciences, University of Iceland
Type of good practice	Statistical consulting to academic staff and graduate students.
Description of the identified good practice	The Statistical Consulting Center provides assistance for statistical analysis of data, but also for other steps of the research process, such as problem formulation, modelling and software. Statistical consulting is provided to academic staff and graduate students at the University of Iceland, School of Health Sciences.
Short description of the main aims, methodology and delivery method (Max. 200 words):	The main aim is to assist Academic staff and graduate students that are analysing quantitative data for research (journal articles etc.) or writing research proposals and grant applications. Researchers can make an appointment for consultation. They are encouraged to share a brief description of the scope of their work in advance. The desired outcome of the initiative is to bridge a knowledge/skill gap that may be present, when researchers from medicine and health sciences are doing applied work that requires specialization in quantitative methods.
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	The importance of applied work
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	The consultation is delivered on an individual level and adapted to the needs of each researcher.
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented.	No, in this particular instance there is no general teaching material or curriculum that can be adapted by other teachers or trainers. The case is presented here, rather as an example of how researchers or practitioners who are experts in their own (non-statistical) field are supported to use appropriate quantitative methods to turn data into new knowledge or insights.
Further comments:	Further description of the service can be found at: http://trhvs.hi.is/english/ . As can be seen from the website, the service is meant for the School of Health Sciences at the University of Iceland, rather than being a commercial venture.



GOOD PRACTICE #2: Moderndive: Statistical Inference via Data Science

NAME OF THE GOOD PRACTICE:	Moderndive: Statistical Inference via Data Science
Type of good practice	A free, online textbook, introducing the reader to data analysis using the R programming language and the R Studio environment.
Description of the identified good practice	<p>Modern Dive was published online, using the bookdown package of the R programming language. The textbook is free to use, and readers/practitioners are encouraged to suggest and submit updates or additions to the text, to keep its material current and to improve it as a learning tool for those wanting to acquire skills in data analysis. The book relies on the Tidyverse collection of R packages for data science, which already has a strong user base and is particularly focused on readability of programming code, which makes it intuitive for newcomers.</p>
Short description of the main aims, methodology and delivery method	<p>Modern Dive is “intended to be a gentle introduction to the practice of analysing data and answering questions using data the way data scientists, statisticians, data journalists, and other researchers would” (see the preface). It is set up as a typical text book, and since it is published online, it references data sets and other resources conveniently through hyperlinks in the text.</p>
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	<p>There is a strong focus on applicability and output from analysis. Data visualization, storytelling with data and the practicalities of data wrangling, where the aim is to prepare and transform a raw data set into one that can be summarized to reveal its inherent information.</p>
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	<p>The chapters are organized with an incremental level or complexity of methods, and navigation through the online book is facilitated by a hyperlinked tree of chapters and subchapters on a panel in the browser window.</p>
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented	<p>Yes, the book is published as open source. Contributors can suggest changes to the published work, or modify and adapt their own instance of the text for their particular purposes, given that the original authors are still referred to.</p>
Further comments	<p>The book is available at https://moderndive.com and from there, links lead the user to data sets, R packages and further resources.</p>

1.2.3 SPAIN

GOOD PRACTICE #1: COURSERA: DATA ANALYSIS FOR DECISION MAKING COURSE

NAME OF THE GOOD PRACTICE: COURSERA: DATA ANALYSIS FOR DECISION MAKING COURSE	
Type of good practice	Online training programme offered by the Institute <i>Tecnológico de Monterrey</i> Via COURSERA
Description of the identified good practice	It is addresses to companies' employees. It covers the analysis and management of large amounts of data, as well as the design and development of models that support decision making in an organization
Short description of the main aims, methodology and delivery method	To support the analysis and management of large amounts of data and the design and development of models that support decision making. Online teaching using videos. It requires designing a final project to apply the concepts, models and tools learned throughout the program in a real situation. When you complete all the courses and the practical project, you get a Certificate.
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	IO2, 3 and 5: <ul style="list-style-type: none"> ✓ Use of videos ✓ The requirement of making up a “project” to apply the concepts, models and tools learned throughout the program in a real situation. ✓ The issue of a certificate after the learning (badges). ✓ The possibility to publish comments from students once they have finalised the learning.
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	No, there are no levels identified. However: <ul style="list-style-type: none"> ✓ It says that corresponds to an “intermediate” level. ✓ It is required to have “Basic knowledge of statistics and use of computational tools” but it does not take any pre-assessment test.
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented.	No. It offers the possibility to share your Course Certificate in the Certifications section of your LinkedIn profile, in printed résumés, CVs or other documents.
Further comments	https://www.coursera.org/specializations/analisis-datos



GOOD PRACTICE #2: MIT: HOW TO PROCESS, ANALYZE AND VISUALIZE DATA

NAME OF THE GOOD PRACTICE:	MIT: HOW TO PROCESS, ANALYZE AND VISUALIZE DATA
Type of good practice	Online training programme offered by the MIT Open Courseware (Massachusetts Institute of Technology)
Description of the identified good practice	<p>This course is an introduction to data cleaning, analysis and visualization. It includes the basics of data analysis through concrete examples. It shows how to take raw data, extract meaningful information, use statistical tools, and make visualizations.</p> <p><i>It was offered as a non-credit course during the Independent Activities Period (IAP), which is a special 4-week term at MIT that runs from the first week of January until the end of the month.</i></p>
Short description of the main aims, methodology and delivery method	<p>It is a free course (see license below). 6 days introduction to data cleaning, analysis and visualization. It is a lab-oriented course where you will learn the basics to take raw data (e.g., emails, logs), extract meaningful information, use statistical tools and make visualizations. It includes:</p> <ul style="list-style-type: none"> ✓ Lecture notes ✓ Assignments: problem sets (no solutions) ✓ Assignments: programming (no examples) <p>Blended: contents online with face to face meetings.</p>
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	<ul style="list-style-type: none"> ✓ Creative commons licence (BY-NC-SA) ✓ Clear 6-day organization ✓ Openness ✓ Downloadable resources: you can download a 24 Mb pack which contains the same content as the online version of the course, except for any audio/video materials and other interactive file types. ✓ The explanation on the syllabus: “what we will teach” and “what we will not teach”.
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	No, it is advanced. It requires working knowledge of Python (from 6.01).
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented	It belongs to the following authors: Adam Marcus, and Eugene Wu. RES.6-009 <i>How to Process, Analyze and Visualize Data</i> . January IAP 2012. Massachusetts Institute of Technology: MIT OpenCourseWare, https://ocw.mit.edu . License: Creative Commons BY-NC-SA . Free to share and adapt. You have to give appropriate credit, provide a link to the license, and indicate if changes were made.
Further comments	https://ocw.mit.edu/resources/res-6-009-how-to-process-analyze-and-visualize-data-january-iap-2012/

1.2.4 POLAND

GOOD PRACTICE #1: TOC for Education Ltd

NAME OF THE GOOD PRACTICE:	TOC for Education Ltd (TOC dla Edukacji Sp. z o.o.)
Type of good practice	Educational initiative including ...an e-learning platform, instructor's guide?? ...
Description of the identified good practice	<ul style="list-style-type: none"> ✓ The offer presented as dedicated packages addressed for specific recipients (e.g. teachers, parents, elementary school students etc.). ✓ Clever commercialization, including not only selling of courses but also in a form of an online store offering educational products, e.g. Educational package "Chest of secrets" with a guide for teachers (30 scenarios) and didactic aids. ✓ The use of communication channels: FB, YouTube. ✓ The way of collecting and presenting knowledge, e.g. a library of examples, a reading room. ✓ In a broader context - the whole online service.
Short description of the main aims, methodology and delivery method	The identified good practices of TOC for Education stand out from the offer of courses, for example as part of CPD. The methods described above (including a way in with the offer is formulated, a concept of commercialization, use of communication channels, etc.) can be adapted to the course in the DUCK project.
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	<ul style="list-style-type: none"> ✓ The way of segmentation of customers and calling them in an understandable way, indirectly taking into account the levels of difficulty. ✓ Presentation of an offer, in fact a commercial one, with a strongly exposed mission. ✓ Integration with social media and dissemination. ✓ A clear way to collect and share knowledge divided into free and paid materials, available in the online store. ✓ The whole website, which creates a specific educational ecosystem, is noteworthy
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	In the given case the level of learners' advancement is linked the level of their education, e.g. a middle school student or results from the profession, e.g. primary school teacher.
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented	The website operates on a commercial basis.
Further comments	http://www.toc.edu.pl/



GOOD PRACTICE #2: Foundation Smarter Poland

NAME OF THE GOOD PRACTICE:		Foundation Smarter Poland
Type of good practice	Learning through a play - An annual competition for the worst chart.	
Description of the identified good practice	The aim of the Smarter Poland Foundation is to popularize science and education regarding methods of data collection, processing and analysis. The indicated competition is one of the activities that stand out for its originality.	
Short description of the main aims, methodology and delivery method	The worst chart competition has been organized since 2012. Through social media and with the participation of interested persons, this initiative facilitates analysis and discussion on unconscious or intentional errors and distortions on data charts used in public space. The charts for the competition can be submitted by anyone; most of them are taken from popular information services and refer to current events.	
Elements of the identified good practice that can be transferable to IO2 – COURSE DEVELOPMENT, IO3 OER RESOURCES, IO4 LLKIT AND GUIDELINES AND IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL	<ul style="list-style-type: none"> ✓ The use of data (charts) that concern commonly known issues. ✓ The possibility of unmasking manipulation or ignorance while maintaining impartiality and objectivity. 	
Do the learning contents of the identified good practice address different levels of learners? How these contents organized and what are the main differences amongst levels?	The competition is not assigned to either the level of advancement or the group of students. It refers to logic and is based on specific examples from popular information services.	
Does the practice identified comply with the accessibility and usability provisions in order to allow teachers and trainers to use its contents? In the affirmative case, please describe the adaptations implemented	No.	
Further comments	http://smarterpoland.pl http://smarterpoland.pl/index.php/2018/12/najgorszy-wykres-2018/	



2. RESULTS OF THE INTERVIEWS

2.1 HUNGARY

5 interviews were conducted to gather views and advice from practitioners in the field of education and training. Interviews were conducted in February 2019, *in situ* at the interviewee's workplaces.

Respondents

ROLE	INTERVIEWEE #1	INTERVIEWEE #2	INTERVIEWEE #3	INTERVIEWEE #4	INTERVIEWEE #5
School level	Professor at University	Head of unit, Educational Authority (former Ministry of Education), Department for Analyses of Public Education	Professor at University	Head of department, Educational Authority (former Ministry of Education), Department for Analyses of Public Education	Professor at University
Specialisation (subjects)	Quality management and business statistics, quality assurance, business quality assurance	National and international assessments	Quality management and business statistics, quality and reliability, Product and process reliability	Pedagogical measurements. Leads the Department responsible for policy-relevant secondary analysis of large public education databases, like the Hungarian Public Education Information System, the international and national large-scale assessments and the Matura.	Quality management, product and process reliability, quantitative methods for management
City/country	Budapest, Hungary	Budapest, Hungary	Budapest, Hungary	Budapest, Hungary	Budapest, Hungary
# Years of experience	35	20	40	20	20

All respondents have strong links with statistics, data analyses and quality management methodologies.



Summary of responses:

- **NEEDS AND EXPECTATIONS:**

Hungary is a clean sheet regarding DUC trainings. However it might be hard to reach those who would profit the most: the Klebelsberg Institution Maintenance Centre (The Klebelsberg Institution Maintenance Centre (KLIK) was established in 2013 with the aim of centralizing funding for public schools, replacing local government funding) employees would also benefit from DUC training.

It is important that school management and KLIK employees understand that understanding these data is for their own good: to see what works and what doesn't. It could be a self-empowerment tool coming from the central government. It is doubtful that we will find good reception for this as the analyses of data on school level is poisoned by the constant rivalry between schools; any data that comes in immediately will be made use for contention.

The Ministry should also take up this task as its role is to inform the public and the public obviously does not understand the educational system clearly regarding school and student assessments.

In the field of industry the biggest problem regarding data collection and understanding is that organisations collect too much data, even if it does not return the investment of budget in collecting it. They are making decisions solely on data and not on technicalities. In app. 70% of cases decision makers could reach a decision without this massive amount of data, they use it to share or counter responsibilities for the decisions.

Specific needs that were pointed out during the interviews include:

- Sensitivity to data, understanding the data sent to school managers from the central government statistical office (Educational Authority)
- Stop mystifying big data theories: learners have to understand that with common sense and proper techniques they will grasp the concepts.
- Students who are not in STEM subjects have a hard time with the math of data understanding and statistics. Training that would teach them basic statistics using only the four basic arithmetic operations would be welcomed.
- Courses have to be visually interesting and engaging.
- High level calculus puts learners off, a management approach would be more welcomed and easier to connect with.
- To be able to show why DUC is meaningful.
- Using xls and statistics apps should not be in the focus. Students are comfortable with xls, but in CPD it would be an obstacle (see #1.)
- Problem-centered approach, using the data well
- Limiting the data: data filtering to be able to make strategic decisions (3-5 data is the amount that one can truly make decisions on)
- Case studies are needed. Transparency of how decisions are based on which data.
- Dealing with data standard deviation
- Statistical basics in math
- Able to see correlations
- Clustering of data



- **What LEARNING OUTCOMES are most promising:**

- Preliminary assessment is crucial, as some of them are professional in .xls and some just get by. At least 3 levels would be good.
- Understanding data as a tool for self-empowerment, a feedback of the work.
- How to identify Key Performance Indicators and strategic indicators

- **What LEARNING RESOURCES, books, and courses recommended for the Data Understanding and Communication course:**

There are no books and courses in Hungary. For managers, directors in public education, there are online resources to prepare them for directing a school, but DUC per se is not part of these prep courses. In higher education the data science field or media studies do not really cover it. A new book is in publishing on Key Performance Indicators, but doubtful that it will be any good from the point of view of the aim of the DUCK project (regard to the general public who uses data).

- **Where will they most likely APPLY THE SKILLS AND KNOWLEDGE OBTAINED DURING THE COURSE:**

- In understanding statistics in relation to their institutions.
- Most likely line managers and medium managers would profit the most from these types of courses to make informed decisions.
- In quality development.
- Academic research and work environment.

In general it can be stated that students are not great in critical thinking, the approach to data, the perspective is very hard to pass on to them. They are not applying DUC methods themselves, it is hard for them to adapt; it is hard for them to unearth analogies.

Employed learners have a much greater motivation to adopt DUC methods. They have their own examples to solve. For them, the theoretical background and the capability to use the methods as well as to learn to adopt a broader perspective in their thinking needs to be learnt.

- **THEIR SKILLS AT THE MOMENT:**

In continuous professional development they have good ICT skills, but low skills in the theory of data understanding (why, what, how). Statistic software, even xls is too high for them, even simple, basic statistics scare learners away.

Regarding school managers in public school system and VET, they have management skills (as they have compulsory CPD course to be able to take the position). All other skills vary differently, that is the reason it would be good to have different entry levels.



In HE students have good ICT skills, however a problem-based approach and data understanding is missing. Msc and PhD students use statistical apps, but they are loitering. They do not filter the data properly; do not map correlations and connections. The problem with apps is that they give results but do not help with the understanding of data.

- **The most important COURSE FEATURES:**
 - **Blended or online?** Should be based on the
 - **For online learning what kind of computer and connection they have?:**
 - **What kind of online teaching media they prefer (presentations, OER...)?:**
 - **Teaching methods:**

Method should be different based on the motivation of the learner: highly motivated learners should have access to the full online course and from there as we progress towards less motivation, to have more and more f2f (face to face) teaching.

Closed CPD, colleagues learning together seems the most promising. Having learners from the same field (not necessarily the same management level or department) together in a f2f or blended course with generally applicable theoretical part and then work on problems of their specific field would be the most fruitful.

The Educational Authority has only f2f courses, however a MOOC would add a lot to the distribution of information. The problem with f2f training is that it is used as a ventilation opportunity for the public school officials to talk about the faults of the system and their work even if the trainer does not have direct contact with the bodies of the decision makers.

- **TEACHER TRAINING INITIATIVES in Data Understanding and Communication that could serve DUCK as example:**

There are no such examples.

- **How much time can they devote to the course**

As a CPD course should be a 2 day course, about 15-20 hours, practice oriented, maybe part of a fuller CPD course. In HE - especially in economic studies - to build up skills it would require 50-60 hours.

2.2 ICELAND

3 interviews were conducted to gather views and advice from practitioners in the field of education and training. Interviews were conducted in March and in May, *in situ* at the interviewee's workplaces.

Respondents

ROLE	INTERVIEWEE #1	INTERVIEWEE #2	INTERVIEWEE #3
Industry	CEO	Specialist	Director
School level	Adult Education	Adult Education	Upper Secondary, Adult Education
Specialisation	Continuous education	Validation of prior learning, methodology	Continuous education
City/Country	Reykjavík, Iceland	Reykjavík, Iceland	Borgarbyggð, Iceland
# Years of experience	18	20	10

All respondents had experience with Adult Education. One respondent worked as a continuous education specialist within a university while the other two worked within organization focused on continuous education, both with strong ties with the labour market.

Summary of responses:

What are the NEEDS that a DUC course should address, and what EXPECTATIONS are expressed?

- Emphasis on practical thinking.
- To be able to figure out what data is interesting/relevant and what is not.
- Being able to use data to deliver a message

Other notes on the topic of NEEDS and EXPECTATIONS:

- People come for training for various reasons. Sometimes it is the employer's initiative and sometimes the employee. It is important to train hands-on, practical abilities
- Reliability of data is also something to consider. Often results (anecdotes) are spread without having been given any critical analysis.
- For working with data, apart from technical skills, it is critical thinking. And knowing how to find and use data from official sources is important. For example, sometimes there is a barrier where people have trouble using/finding the data from Statistics Iceland's website
- Knowing what to consider/take into account when the data is gathered
- How to interpret data and figures



What **LEARNING OUTCOMES** are the most promising?

- Critical thinking
- How to use data to support the message/agenda/cause that is being delivered

Other notes on the topic of **LEARNING OUTCOMES**:

- Being able to use data to deliver a message
- To work with, and communicate labour market data
- The suggested DUC program very positive but not a primary objective for most. It can still be a part of the more general aim of opening new educational opportunities for people from various sectors.
- To be able to communicate facts, to properly present the evidence that supports their argument. F.ex. when it comes to wage negotiations, being able to communicate facts about development of purchasing power, inflation, wages etc.
- The overall aim of the VET training is to raise the level of competences in general, and to raise the image/reputation of specific groups/trades

The most important **COURSE FEATURES**?

- Learning by doing.
- Blended learning. Lectures delivered online, but personal interaction must not be eliminated.
- Group work. It is important to bring the students together (often a very diverse group).
- Active work takes place in the classroom. Discussions and dialogue is very important for the learning experience.
- They prefer blended learning or classroom teaching for the general trainees. When training the trainers, online material may be used more.
- Diverse methods should be used.
- Keeping student active is important

How much **TIME** can they devote to such a course?

- Around 3 hours per week
- No clear answer. Flexibility, being able to take only specific modules is good. The 30 hours mentioned seems OK.
- A 30 hour course would need to be spread quite thin. Commonly, students come for 3 hour classroom sessions 1-2 per week during a course. More workload than that is maybe not feasible.

2.3 SPAIN

In Spain **3 responses** were obtained in the period January-February 2019. We hereby include a summary of the profile plus the answers.

ROLE	INTERVIEWEE #1	INTERVIEWEE #2	INTERVIEWEE #3
School: level	Professor at University	Professor at University	Secondary Education teacher
Specialisation (subjects)	Specialisation (subjects): eLearning and social networks and design and development of technological projects	Economy, history of economy and accounting	Labour market training and career counselling
City/country	Málaga. Spain	Almería. Spain	San Fernando (Cadiz). Spain
# Years of experience	6	3	5

Summary of responses:

- NEEDS AND EXPECTATIONS:** the 3 interviewees reported a high interest and a real need. “The needs of the students are different now and the skills of the teachers need to be adapted accordingly”. It was also reported that the needs of the teachers are related to the methods and tools to “analyse, select, adapt and communicate data related to their teaching subjects and also to create their own digital/visual teaching materials”
- What LEARNING OUTCOMES are the most promising:** the so called “*Competencia para el tratamiento de la información y competencia digital*” was mentioned, that is, the competency to treat information in the frame of digital skills (definition: *This competence consists of having the skills to seek, obtain, process and communicate information, and to transform it into knowledge. It incorporates different skills, ranging from access to information to its transmission in different media once it has been processed, including the use of information and communication technologies as an essential element for information, learning and communication. Moreover, key transversal competences leading to acquire basic analytical, communication, digital and learning to learn skills were mentioned.*
- What LEARNING RESOURCES, books, and courses recommended for the Data Understanding and Communication course:** Books, courses and INTEF in Spain (though, in Spanish (what is INTEF?)): particularly their NOOCS, Nano Online Courses. <http://nooc.educalab.es/>. Also, courses to implement evaluation rubrics, Moodle courses in ICT competences and Social media, WebQuests, Educational Blogs... were mentioned.
- BEST PRACTICES in that area in including experiences with students, what works and does not work:** It was mentioned that “(it) *does not work to give for granted they will understand data. It works to ask them directly and to be very proactive, presenting them the key questions and then ask them what they do not understand and why. Then I hold some specific face to face sessions to those students that need more support.*” Also the need to adapt to the level of the learners and creating a clear link with them was mentioned.



- **Where most probably they will APPLY THE SKILLS AND KNOWLEDGE OBTAINED DURING THE COURSE:** in their daily job if they are working and in their future jobs and in their studies.
- **THEIR SKILLS AT THE MOMENT:** It was reported that the students skills were *“In general, very basic but some, particularly those that work, that are more knowledgeable and can make graphs on their own and “discuss” them properly.”* Moreover, *“I’d say basic but some, are more proactive”*. Also soft skills were mentioned related to our DUC focus: “communication skills are quite low including basic personal skills as empathy, ethics, conflict resolution, etc.”
- **The most important COURSE FEATURES:**
 - **Blended or online?:** *Online/not sure/ Preferably f2f but blended could be an option*
 - **For online learning what kind of computer and connection they have?:** *Most of them a good connection/ definitely all of them have mobile phones!/Laptop, iPad (many of them use it as there are special deals for public teachers) and smart phone*
 - **What kind of online teaching media they prefer (presentations, OER...)?:** OER presentations and videos/ Presentations and videos
 - **Teaching methods** (group work, storytelling, role playing, online collaboration...etc.)?: case studies and online collaboration/collaboration/role playing
- **TEACHER TRAINING INITIATIVES in Data Understanding and Communication that could serve DUCK as example:**
 - YES: INTEF in Spain (National Institute of promotion of digital technologies for teachers and trainers) delivers info sheets and courses for teachers in for example, how to prepare info graphics in the classroom: <http://educalab.es/intef/tecnologia/observatorio-tecnologico/cajon-desastre/infografias-y-competencia-digital>
 - There is a course in ES: data bases for teaching. It is about how to use data bases <http://educalab.es/-/bases-de-datos-en-la-ensenanza>. also for *corubrics* and how to use them for education: <https://intef.es/wp-content/uploads/2019/02/Corubrics-1.pdf>. Or: Use, Big data and economy online: http://enlinea.intef.es/courses/course-v1:INTEF+CuandoAceptasDIG+2019_ED1/about
 - Online Tutor: <http://www.educacionyfp.gob.es/mecd/dms/mecd/servicios-al-ciudadano-mecd/catalogo/general/educacion/201533/ficha/201533-2018-2/13-Ficha-INTEF-Tutor-en-red.pdf>
Introduction to Courses Syllabus development for Secondary Education Teachers:
 - https://www.edu.xunta.gal/centros/cfrcoruna/aulavirtual2/pluginfile.php/14842/mod_resource/content/1/20170329_programacion_secundaria.pdf
- **How much time can they devote to the course**
 - 1-2 hours per week
 - Max.: 2-3 hours per week
 - Max.: From 3 to 4 hours/week

2.4 POLAND

3 responses extracted in the period January-February 2019. We hereby include a summary of the profile plus the answers.

ROLE	INTERVIEWEE #1	INTERVIEWEE #2	INTERVIEWEE #3	INTERVIEWEE #4
School: level	HE and SE teacher	Professor at University	HE teacher	Primary Education teacher
Specialisation (subjects)	Human Resource Management (HE) and Programming (SE)	Electro technics	Psychology	Mathematics, Physics, Chemistry
City/country	Lublin, Poland	Warsaw, Poland	Lublin, Poland	Lublin, Poland
# Years of experience	8	15	20	18

Summary of responses:

- **NEEDS AND EXPECTATIONS:** all interviewees reported a high interest and a real need. They confirmed that this subject is very important and much needed. 2 persons pointed out that they would be mostly interested in improving their presentation skills, 1 person was interested in improving his statistics knowledge, and 1 person would like to learn “Where she can find new information for her subjects? What are reliable sources of information and pages with data? How she can try to teach children critical thinking during her subjects where there is not too much time for extra activities?”
- **What LEARNING OUTCOMES are the most promising:** Participants underlined that it’s important to show teachers how to update their knowledge, as there are no such a courses. They would be interested to learn what are reliable sources of information (where to find facts, statistics), topics that inspire (repositories with problems and data, reliable data points) and tools (e.g. show places with infographics which may be used at school). One person mentions that development of critical thinking is very promising to him.
- **What LEARNING RESOURCES, books, and courses recommended for the Data Understanding and Communication course:**

Book: “The Half-Life of Facts: Why Everything We Know Has an Expiration Date Reprint Edition” by Samuel Arbesman: <https://www.amazon.com/Half-Life-Facts-Everything-Know-Expiration/dp/159184651X>

Book: “Oxford IB DP Course Book: Theory of Knowledge” by Dombrowski Eileen, Rotenberg Lena, Bick Mimi.

Book: “slide: ology: The Art and Science of Creating Great Presentations” by Nancy Durate



LEARNING METHOD:

- Project-oriented and Problem-based Learning (PBL):
- https://en.wikipedia.org/wiki/Problem-based_learning
- https://en.wikipedia.org/wiki/Project-based_learning
- An example from his field: <https://www.pbl.aau.dk>
- Teaching and learning in higher education: perspectives from UCL, 2018
- <https://www.ucl-ioe-press.com/ioe-content/uploads/2018/05/Teaching-and-Learning-in-Higher-Education.pdf>
- Other keywords: research-based learning

PRESENTATIONS, BOOKS, AUDIOBOOKS:

- <https://www.audible.co.uk/pd/TED-Talks-Audiobook/B01DTEAK6W>
- <https://www.audible.co.uk/pd/Five-Stars-Audiobook/B07D9S176R>
- <https://www.youtube.com/watch?v=KbSPPFYxx3o>
- <https://www.youtube.com/watch?v=lwpi1Lm6dFo>
- <https://www.youtube.com/watch?v=bOrHxRB3JrQ>
- <https://www.audible.co.uk/pd/The-PBL-Playbook-A-Step-by-Step-Guide-to-Actually-Doing-Project-Based-Learning-Audiobook/B07NGZHFWJ>
- <https://www.amazon.co.uk/Creative-Schools-Revolutionizing-Education-Ground/dp/0141978570>
- <https://www.amazon.co.uk/Make-Stick-Science-Successful-Learning/dp/0674729013>
- Robot-Proof by Joseph E. Aoun, 2017
Higher Education in the Age of Artificial Intelligence
- I Love Learning; I Hate School by Susan D. Blum, 2017
An Anthropology of College

Also, publications related to user experience, where UX discusses data presentation issues were mentioned.

- **BEST PRACTICES in that area in including experiences with students, what works and does not work:** In this part all interviewees shared their experiences and cases they use while working with their students and pupils. Below list of examples:

Examples from Business Faculty:

Example 1

In frame of the classes students prepare for example business ideas. Students have to think about aims (SMART), they have to work with data (not only intuition) and have to present it. Students have problems with setting goals in SMART way and with presentations. They don't use graphs or infographics.

The ability to estimate e.g. income is also important. To do it they have to have data, and the problem is the data's sources - where to get it, how to predict it. And he, as a teacher, needs methods which would confirm the probability of these estimates. But this way of working with students from business faculties works.



Examples from Psychology:

Example 2

Choose an attractive, emotional topic (emotionally engaging, related to the subject and where there is access to statistics), which shows that following incorrect assumptions and views, we misunderstand the problem and we do not see the problem seriously. That as there are 2 sides of the barricade we do not try to solve the problem, but we share. Each work can be seen from different perspectives, e.g. government, EU, eco, gender, etc.

Example 3

You can do a simulation: look at the problem from this perspective, here are your data. Then: there may be searching for arguments, information.

A role-playing game that helps understanding the problem. Already after this phase, participants gradually change their perspective; they begin to understand different points of view.

Then, we find objective information and confront them with these data. Data collection and verification.

There is a change in the dynamics of views based on facts and not on emotions.

If there is little information completed with own beliefs, then there is a strong level of emotion.

The analysis shows that the problem is more complex, reduces radicalization, and opens to a wider perspective.

Example 4

Another exercise: the instructor ask participants to draw a few geometric figures, gives the commands e.g. "draw a circle and the square goes away from it, etc.". Participants cannot ask any questions.

Then the second time tells them to draw the same, gives commands, but they can already ask. And what turns out? If you collect information - you look more widely. These 2 items can vary. Question to students: Looking at the problem, do you see that others can see it differently?

Example 5

Students have to prepare presentation in groups. Then each group presents. And then there is a question to other students: what you liked about this presentation? What would you improve? So the group has a feedback from other students. And one question to the group that presented: what grade would you set for yourself?

Important remark:

The method of teaching students these skills must be a philosophy for the whole class. That it would not be tricks for students, but a certain philosophy. Then there is a chance that they will learn something.

Example: Process in the field of Electro mobility

Example 6

At the beginning of the class I present basic cognitive biases and I encourage you to read / listen to at least one popular science book from this area, e.g. *The Sceptics' Guide to the Universe: How to Know What's Really Real in a World Increasingly Full of Fake* by Steven Novella et al., 2018.



I pay attention to the existence of predatory publishers (fake science factories). I show the scale of the phenomenon on the example of OMICS group, Waset, Science Domain International, Science Publications, and IOSR Journals (International Organization of Scientific Research), https://youtu.be/ras_VYgA77Q?t=2331.

I give teams of 3 to 5 people problems to solve. And here will be the first hook - ca. 20% of problems will not make sense, i.e. no physical sense or lack of usability or expected parameters exceeding our current technical capabilities by an order of magnitude. The students' task will be to identify ill-posed problems and reformulate them or even exchange them for another available in the pool. We finish this stage with a short reporting of identified errors during the formulation of requirements / expectations. Each team should also be convinced and able to give proper indications that the problem is not only well-placed from the point of view of its potential solvability, but that it makes sense to devote time to trying to solve it.

Acquiring detailed data needed as an assumption for the device being developed, including a critical evaluation of the research results already published on the subject and declared parameters of devices commercially available. This discrepancy between the declared and actual parameters of devices is particularly evident in cheap, unbranded consumer electronics. I am not talking about demonizing these products, but about their substantive evaluation, for example, writing on the camera about 3000 pixels, that it is 4k, is misleading. Similarly, we declare slow motion capability, when we only have the option of recording 30 frames per second, and the alleged slow motion is achieved only by repeating identical frames.

The ability to interpret and question the observed results of computer simulation. A common mistake is wrong data entry e.g. 1H instead of 1 mH, 1 F instead of 1 mF, 1000 rad / s instead of correctly converted 1000 rpm for rad / s, etc. As a result, the results are missed by at least an order of magnitude. The student often does not catch it and in good faith (presumption of innocence) gives the project for evaluation. Why? Probably because at the beginning he could not assess based on the simplified model of the expected range of the output of the system. This skill must be developed by a modern engineer flooded with fake sci-fi stories from the world of fake science. This is also a problem of some modern models of engineering education, in which dangerously we leave the laboratories / hardware workshops, due to their cost-consuming, in favour of computer simulations. Computer simulation is an important stage of the project, but the student's design adventure should not end there. Hence the idea of introducing large PBL modules (12 ECTS) allowing the instructor to conduct the student through all stages, i.e. including the construction of the physical model, even if due to financial constraints it will be on a scale of, say, 1:20.

Presentation of research results and conclusions drawn, as well as formulated recommendations. A very important skill, which in my opinion is too underdeveloped in students. Ability to select representative results. Choosing the right graphic form. I will not mention the meaning of what the histogram illustrates, for example, that by specifying present changes, the correct reference level should be chosen. The ability to put yourself in the role of the recipient of the presentation, which, for example, does not know what is on the axes, if we do not describe it, in accordance with the art of making any graph.

Especially I give a presentation of simulation results even before building a physical model - so that the other teams and the leaders can give feedback before we go to potential gray smoke generators.

In my opinion, the on-line course on critical thinking as the key tool problem solving could be embedded in the context of PBL classes. In the Polish education in many areas, unfortunately, we are still in the paradigms of education from 100 years ago. Some nations wake up, or have already woken up, and have been using PBL since the beginning of K-12 education, and not just in higher education.

Going to build a physical model (mechanics, power electronics, electronics, software) I think that it would be worth to present some methods of systematic search for the causes of the device's malfunction. Root cause analysis (RCA)?

A few words about authority. Instructor should not act as an authority. The student should feel that there are no circumstances exempting him from independent thinking, making decisions on his own, and independently verifying and assessing the effects of these decisions. And as a result of independent assessment of the usability of the constructed device. Currently, students too often ask the teacher questions after every even the smallest design decision for its correctness. They are, in effect, guided by the hand and they are not learning how to solve problems by themselves. In addition, they expect that they will receive a set of materials (books, articles, catalogue cards and other studies) needed to complete the task, and they expect them in Polish [sic!]. And the total relic of the past is the laboratories with the exact instructions for the exercise - it was good when we educated primarily the employee performing a repeatable activity on the production line. However, it does not match the current needs of the labor market. Repeated activities are more and more often "commissioned" by robots.

Example from primary school

Example 7

The method of kidding children is checked.

They agree with something, and after changing the tone of the voice they stop agreeing.

Some psychology techniques to influence people are working.

Where most probably they will APPLY THE SKILLS AND KNOWLEDGE OBTAINED DURING THE COURSE: Working with their students and pupils during their classes. Teaching them to ask questions (the art of questioning), making a habit that they have to verify what they hear or read and how to present findings.

One person underline that he could use this knowledge also in professional life (for reports) and in everyday life.

- **THEIR SKILLS AT THE MOMENT:**

The abilities teachers have and which were mentioned during interviews are the following: Maths, critical thinking, ability to estimate, ability to present more difficult data in a graphic way to be understandable for the average person, ability to catch trends in data, ability to read emotions.

- **The most important COURSE FEATURES:**

- **Blended or online?:** *Traditional F2F workshops/ Online would be OK. But also all day training could be good for teaches/ It depends on content, but rather blended.*
- **For online learning what kind of computer and connection they have?:** *Personal laptop with good internet connection*
- **What kind of online teaching media they prefer (presentations, OER...)?:** *Case studies. Scenarios of use. Tools. Databases./ It depends on content. But presentations, films,*



exercises would be OK. / It depends on content. But presentations and a lot of simple, practical exercises would be valuable

- **Teaching methods** (group work, storytelling, role playing, online collaboration...etc.):
Group work/ Self-learning (working with content) and collaboration. Important role of the tutor, who would set deadlines etc.

Comment:

Teachers underlined that if the course will be interestingly designed, with good content and activities, regardless of the form, they would get involved. They must first see their interest: what will they gain from taking part in it? How will their classes with students become better after this course?

At the beginning, they would like to get preliminary information, which would justify why it is worth participating in this course. That would be a kind of pill that would involve them.

If based of this information they would decide that it is OK, they would get involved.

- **TEACHER TRAINING INITIATIVES in Data Understanding and Communication that could serve DUCK as example:**

No examples were given by any of teacher.

- **How much time can they devote to the course**
 - Series of 3-hours workshops at school
 - 20h for the course
 - Blended course for 1 semester (30 hours). 2-4 hours a week. More F2F workshops.
 - It depends on the course content. Hard to say if he doesn't know any detailed information how he will benefit and what will be his duties in frame of the course.



3. RESULTS OF THE SURVEY

3.1 HUNGARY

In Hungary there were two types of surveys: one that targeted educators and educational professionals that relate to DUC in some capacity. The other survey was targeted to industry representatives, who work as managers, line managers and who use DUC skills in their work and/or train the new, entry level employees thus having a good impression of their existing and missing skills.

The two survey results presented separately when needed and combined when possible. All together the number of responses from Hungary is 24, with feedback from 14 educators and 10 industry representatives.

Survey #1

GENDER	AVERAGE AGE	LENGTH OF SERVICE AS EDUCATOR / TEACHER	FIELD/SECTOR	AGE OF STUDENTS	SIZE OF THE CLASS
6 women	53 years old of average	18 years as average	HE 5	11 respondents: 20 or older	9 respondents: between 10-30
8 men			CPD (trainers) 5	3 respondents: secondary education students	3 respondents: less or exactly 10
			VET 4		3 respondents: more than 30

Survey #2

GENDER	AVERAGE AGE	LENGTH OF BEING IN POSITION WHERE DUC SKILL IS NEEDED	SIZE OF COMPANY	DO THEY TRAIN NEW ENTRIES	AGE OF TRAINEES
4 women	39 years old of average	9 years as average	3 Small company (<100 employees)	6yes	2: usually older than 30
6 men			2 Medium size company (100- 1000 employees)	4 no	4: usually between 20 and 30
			4 Large company (>1000 employees) 1 government body		

The first set items in the survey focused on which skills to develop in a DUC course. Answers were given on a Likert-style scale. For the table below, answers were enumerated on a range of 1 through 5 and averages calculated, with the lowest averages indicating most agreement.



Choice of skills the students should get

SKILLS	AVERAGE
<i>Be able to use popular tools (like MS Excel) to identify the most important features of data sets</i>	1,7
<i>Be able to efficiently communicate conclusion in a "human" language (e.g. storytelling)</i>	1,5
<i>Be able to inference important and interesting conclusions from data analytics</i>	1,4
<i>Be able to visualize results in simple and nice form</i>	1,4
<i>Be able to prepare massive amount of data for analysis (cleaning data, etc.)</i>	1,5
<i>Be able to identify typical reasoning and interpretation pitfalls, basing on cognitive psychology discoveries</i>	1,8
<i>Be able to formulate the best possible questions in order to look at data from appropriate perspective</i>	1,5

Other:

- Understand the structure of databases, make diagrams
- It would be important that students would be able to present the findings and result orally as well as in writing
- Systematically thinking, knowing inner correlations
- Being able to navigate and to research in different types of databases.
- In my teaching practice, the following simple data analysis scheme is generally used:
 - > formulating professional problems (e.g. engineering, economics, psychological, biological) in professional terms
 - > redrafting the professional problem into the language of the data in statistical terms
 - > planning and executing data collection
 - > planning data analysis and implementation
 - > formulating the results of data analysis in terms of statistics (data analysis)
 - > reversing statistical (data analysis) results to original professional issues
 - > finding the most appropriate presentation / visualization of professional results (referring to the most necessary statistical results on which they are based)

Note: these steps only rarely can a single expert perceive / perceive, usually the "professional expert" and "data analysis expert" divide. This is not a problem as long as you have known the partner's field of expertise to a minimum level and they can communicate well with each other.

Choice of Media and Educational Materials

MEDIA AND EDUCATIONAL MATERIALS	AVERAGE
<i>ANIMATED PRESENTATIONS</i>	1,6
<i>SLIDES FOR OVERHEAD PROJECTOR</i>	1,6
<i>OPEN EDUCATIONAL RESOURCES (OER)</i>	1,7
<i>Audio and video files</i>	2,0
<i>Learning platforms</i>	2,0
<i>Infographic</i>	2,0
<i>Internet link lists</i>	2,4
<i>Printable worksheet</i>	2,4

So we can see that the preferred methods are:

- Animated presentations
- Slides for overhead projector
- Open Educational Resources

Comments:

Training example data files (MS Excel, IBM SPSS Statistics / Modeler, MS Access, SAS, Rapid Miner, etc.), the content of which has been elaborated / explained in detail by the course. If these can be reproduced by the learner that can greatly enhance a deeper understanding.

Choice of Methods

METHODS	AVERAGE
STORIES AND CASE STUDIES	1,4
EVERYDAY LIFE PROBLEMS	1,5
GROUP WORK	1,6
Frontal instruction	2,1
Self-learning	2,2
Data reported by news media (newspaper, TV, radio)	2,2
Storytelling	2,5
Role playing	2,9

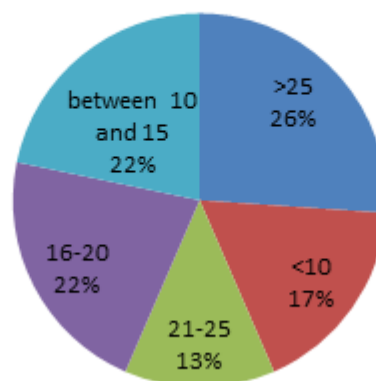
Suggestions of additional methods:

- Intermediate testing, blocking progress until successful
- Solving exercises alone, with possibility of consultation
- online collaboration with supervision by a mentor

Time, Preferences and Concerns

Regarding the **TIME THAT COULD BE DEVOTED TO THE COURSE**, the respondents gave an almost balanced vote for all 5 possibilities.

Ideal lenght of course



Regarding their **CONCERNS ABOUT THE COURSE**, the length of the course, the questions if it is really worth it for them and the value for many came up among the following:

- Maintaining efficiency, attention, interest
- I might not be able to comprehend it
- The level of knowledge of mathematics may greatly differ within the learner's group, familiarity with statistics may cause a problem in learning data analyses.

- Long presentations
- Lacking knowledge of MS Office
- Too conventional, stereotyped, trite
- Elimination of data interdependence, endogeneity
- If it became schematic (to avoid this, many very different problems and solutions should be presented ...)
- Data protection and specifics of certain professional fields.
- Value for money
- Practical experiences do not get built in the course
- Takes too much time
- Focusing on non - free support tools (hidden marketing).
- That it would be boring "data bugging."
- is not related to mass production
- There is no general solution to specialization.

As to the question "What would make a course on Data Understanding and Communication INTERESTING FOR YOU TO PARTICIPATE?" the following focus points were defined:

- **Methodology**
 - Having a real cases methodology and flexibility (for me to be able to adapt to my timings)
 - If the methodology is interesting and I see the value
 - Easy to follow, with real cases and data
 - Clear learning objectives and see the benefit from the beginning for my professional and also personal development
 - I have little spare time to follow professional development courses so it would have to be very clearly presented and the benefit very straightforward
- **Usability and flexibility**
 - if it is not too long and adapted to my needs I would participate
 - real case examples and connection with BIG DATA and new professions for my students
 - being able to select the modules/units most interesting for me
 - it is practical oriented
 - That it was understandable and practical to implement
 - that was animated and interesting including real life examples, from the press, applicable to a class
- **Enjoyable**
 - Catchy wordings and presentation
 - If the theme is dealt with real life cases in a nice and friendly way

Suggestions for the DUCK team

- Many graphs, algorithms, good examples are key to success
- Area-specific elements, e.g. analyses by industry
- A prior mathematical summary would be much needed.
- The approach should obviously be different for "IT teachers" (who are "data analysis experts") and for all other teachers (who are "technical experts"). For the former, it is really important to teach the primacy of the professional problem (a kind of humility to the

"customer"), and for the latter, mastering the basics of "data science" so that they can effectively communicate with data analytics experts ').

- Possibility of online course participation
- Accreditation of training
- Follow up of training

3.2 ICELAND

GENDER	AVERAGE AGE	LENGTH OF SERVICE AS EDUCATOR / TEACHER	FIELD/SECTOR	AGE OF STUDENTS	SIZE OF THE CLASS
2 female	42,3 years old of average	10,9 years as average	10 HE		1 respondent: < 10
9 male					2 respondents: 10-15
				2 respondents: 20-25	0 respondents: 16-20
			4 VET	5 respondents: 25-30 or older 4 respondents: Above 30	4 respondents: 21 – 25
					1 respondents: 26 – 30 3 respondents: > 30 pupils

A total of 11 responded to the DUCK survey in April and May of 2019. The sample can best be described as convenience sampling

Nearly all respondents of the sample were male, but this does not reflect the population of the teachers approached. Admittedly, there is a gender imbalance in the main group that was targeted by the survey, teachers at Bifröst University. All respondents had a minimum of 5 years of experience as educators, and some, significantly longer. A typical respondent is 40 year old male with 5-10 years of experience, teaching students around the age of 30 in classes of 25 students.

The first set items in the survey focused on which skills to develop in a DUC course. Answers were given on a Likert-style scale. For the table below, answers were enumerated on a range of 1 through 5 and averages calculated, with the lowest averages indicating most agreement.

SKILLS	AVERAGE
<i>Be able to visualize results in simple and nice form</i>	1,3
<i>Be able to use popular tools (like MS Excel) to identify the most important features of data sets</i>	1,7
<i>Be able to efficiently communicate conclusion in a "human" language (e.g. storytelling)</i>	1,8
<i>Be able to inference important and interesting conclusions from data analytics</i>	2,2
<i>Be able to formulate the best possible questions in order to look at data from appropriate perspective</i>	2,3
<i>Be able to identify typical reasoning and interpretation pitfalls, basing on cognitive psychology discoveries</i>	2,3
<i>Be able to prepare massive amount of data for analysis (cleaning data, etc.)</i>	2,8



For the seven items listed, those that respondents were in most agreement with, focused on the simpler or basic skills, rather than more involved analysis. The preferred skillset might be summarized as *the ability to communicate findings visually, using standard tools such as MS Excel*. Perhaps the most involved type of task suggested, suggesting a *massive* amount on data and sufficing with *only* preparing that data for further analysis, was also the skill least favoured. And as such, comes in last as a desired learning outcome for the DUC module.

MEDIA	AVERAGE
<i>Info-graphics</i>	2,2
<i>Open educational resources (OER)</i>	2,2
<i>Learning platforms</i>	2,2
<i>Audio and video files</i>	2,5
<i>Internet link lists</i>	2,7
<i>Printable worksheets</i>	3,2
<i>Animated presentations</i>	3,2
<i>Slides for overhead projector</i>	3,2

When stating preferences on different types of media for the OERs, respondents were less decisive, answers tending to be closer to the neutral point of the scale. The preferred style of media inferred from the results could be generalized as *an open access learning platform, with teaching material relying heavily on visuals (i.e. info-graphics) to explain concepts and methods*. Printable worksheets and animated presentations scored lower, as well as the slides for the overhead projector which are largely obsolete in today's classrooms.

The final set of items concerned the methods used to deliver the teaching material. The methods proposed were diverse, fit for teaching in classrooms, or through distance or blended learning. The method that most supported was Group work, with stories and case studies coming in second. For the other items in the list, respondents were fairly neutral, with the exception of role playing which was the least favoured method.

METHOD	AVERAGE
<i>Group work</i>	2,0
<i>Stories and case studies</i>	2,2
<i>Lecture-style instruction</i>	2,5
<i>Data reported by news media (newspaper, TV, radio)</i>	2,5
<i>Self-learning</i>	2,7
<i>Storytelling</i>	2,7
<i>Everyday life problems</i>	2,7
<i>Role paying</i>	3,3

Keeping in mind that those answering are typically teachers/instructors and not students, a suggestive description of the most favoured teaching method could be *students working in groups, adopting the DUC concepts and methods by analysing cases and real-life scenarios*.

When asked, how much time one could devote to a DUC course, the most common answer was 21-25 hours (5 responses), while one respondent indicated 10-15 hours. With the proposed length of the DUC course being 30 learning hours, this may well fit the current setup, in particular if there is some flexibility in selecting or omitting certain units from the module.

Respondents were asked what would make a DUC course interesting for them to attend, what their main concerns were and finally, what they would suggest for the course's design.

On the topic of making a DUC course more interesting, the most important learning outcomes seem to be

- Being able to summarize and present data quickly
- Tackling real life problems as we see them in the workplace.

Also, to acquire training in using "gold standard" software and ensuring that the topics are relevant to specific study fields.

Regarding concerns about a new course on Data Understanding and Communication course, the answers given were

- Complexity and the need for programming such as R. Students need to grasp the relevant fundamentals first. Then we can introduce them to larger data sets.
- General lack of emphasis on dealing with real data.
- Too complex and hard to understand what data matters and should be analysed.

And finally, as suggestions to course designers,

- We need a clear picture of the "end product." Meaning, we need to understand the relevance of teaching this as it is laid out by others.
- Just start from a real dataset that has to be cleaned, mutated and manipulated.
- Analyse a large data set in a case study setting for example and how students can extract data with the right tools such as excel or other. Step by step application, critical thinking and creative thinking is important as well.

3.3 SPAIN

In Spain we obtained 30 responses, extracted during the month of April 2019. We will include here below a summary of the profile of the respondents, followed by the results regarding the skills the students should get, the choice of media and methods.

Profile of the respondents:

GENDER	AVERAGE AGE	LENGTH OF SERVICE AS EDUCATOR / TEACHER	FIELD/SECTOR	AGE OF STUDENTS	SIZE OF THE CLASS
21 female	38,8 years old of average	9 years as average	10 HE	3 respondents: Below 15	2 respondents: < 10
7 male			10 Secondary education	11 respondents: 15-19	6 respondents: 10-15
3 prefer not to answer			5 Training of trainers	8 respondents: 20-25	3 respondents: 16-20
			3 VET	6 respondents:	13 respondents: 21



	25-30 or older	- 25
		2 respondents: 26 – 30
		3 respondents: > 30 pupils

The average respondent is a 39 year old woman with 9 years of experience. We have a combined profile including expertise in HE, VET, secondary education and training of trainers. The average age of the students is 15-25 and the size of the class is 10-25 students per class.

Choice of skills the students should get

Participants were asked to rate a set of skills according to *1 definitely agree to 5 definitely disagree*. We can see below the results, which show that **all the Spanish respondents AGREE on all the proposed skills**:

SKILLS	AVERAGE
<i>Be able to use popular tools (like MS Excel) to identify the most important features of data sets</i>	1,1
<i>Be able to efficiently communicate conclusion in a "human" language (e.g. storytelling)</i>	1,1
<i>Be able to inference important and interesting conclusions from data analytics</i>	1,2
<i>Be able to visualize results in simple and nice form</i>	1,2
<i>Be able to prepare massive amount of data for analysis (cleaning data, etc.)</i>	1,3
<i>Be able to identify typical reasoning and interpretation pitfalls, basing on cognitive psychology discoveries</i>	1,3
<i>Be able to formulate the best possible questions in order to look at data from appropriate perspective</i>	1,4

Other:

- *Instead of "Be able to visualize results in simple and nice form" maybe i would go for "being able to PRESENT results..."*
- *"Be able to use popular tools (like MS Excel) to identify the most important features of data sets": IDENTIFY AND PRESENT (for example: make useful and understandable graphics*

And insist on the communication side, that is, not only prepare, use and formulae questions but also present results such as for example, *make useful and understandable graphics*.

Choice of Media and Educational Materials

MEDIA AND EDUCATIONAL MATERIALS	AVERAGE
<i>PRINTABLE WORKSHEETS</i>	1,2
<i>INFOGRAPHICS</i>	1,2
<i>ANIMATED PRESENTATIONS</i>	1,5
<i>Open educational resources (OER)</i>	2,0
<i>Internet link lists</i>	2,0
<i>Audio and video files</i>	2,1
<i>Learning platforms</i>	2,2
<i>Slides for overhead projector</i>	3,3 ↓

So we can see that the preferred methods are:

- Printable worksheets
- Infographics
- Animated presentations



Comments:

- *Slides for overhead projector: this is way too old*
- *We have no availability for overhead projectors anymore*

Choice of Methods

METHODS	AVERAGE
DATA REPORTED BY NEWS MEDIA (NEWSPAPER, TV, RADIO)	1,2
EVERYDAY LIFE PROBLEMS	1,5
STORIES AND CASE STUDIES	1,7
SELF-LEARNING	1,7
GROUP WORK	1,8
Frontal instruction	2,0
Role playing	2,4
Storytelling	3,0 ↓

Comments:

- *Not only group work but collaborative learning techniques*
- *I am not sure about role play in this issue.... maybe mock sessions about data presentations?*
- *Collaborative learning*

Time, Preferences and Concerns

Regarding the **TIME THAT COULD BE DEVOTED TO THE COURSE**, most of the respondents replied they could devote LESS THAN 10 HOURS, 6 of them said that between 10 to 15 hours.

Regarding their **CONCERNS ABOUT THE COURSE**, again the time (that is the course being too long) and the attractiveness of the course were the 2 factors most commented by the respondents.

As to the question “What would make a course on Data Understanding and Communication INTERESTING FOR YOU TO PARTICIPATE?”, the respondents shared their concerns about:

THE LITTLE TIME THEY HAVE:

- ✓ *Short and focused*
- ✓ *Short and focused*
- ✓ *if it is not too long and adapted to my needs I would participate*
- ✓ *I have little spare time to follow professional development courses so it would have to be very clearly presented and the benefit very straightforward*

THEY NEED TO SEE REAL LIFE EXAMPLES AND A CLEAR APPLICABILITY WITH THEIR STUDENTS

- ✓ *Real life examples*
- ✓ *Real cases and very practical*
- ✓ *Having a real cases methodology and flexibility (for me to be able to adapt to my timings)*
- ✓ *Real case examples and connection with BIG DATA and new professions for my students*
- ✓ *Easy to follow, with real cases and data*

- ✓ *If the theme is dealt with real life cases in a nice and friendly way*
- ✓ *if it is practical oriented*
- ✓ *That it was understandable and practical to implement*
- ✓ *If it is animated and interesting including real life examples, from the press, applicable to a class*
- ✓ *If I can apply it in my class*
- ✓ *Being as close to reality as possible.*
- ✓ *Cases and stories linked to the problems teachers may have related to DUC*
- ✓ *News from the press, understanding how important is this issue and how important will be in the near future*

RESPONDENTS NEED TO PERCEIVE THE BENEFIT IT WILL HAVE

- ✓ *Having a very clear benefit for me (for example: you will be able to help your students better understand and communicate data by...)*
- ✓ *Clear learning objectives and see the benefit from the beginning for my professional and also personal development*
- ✓ *if the methodology is interesting and i see the value*
- ✓ *Better understand how important this issue is and how I can improve my class teaching and learning*
- ✓ *First better understand then theme and its importance to teaching and learning, afterwards very practical ways and techniques to apply to my class*
- ✓ *Make it interesting according to age groups of learners (close to their interests)*
- ✓ *Catchy wordings and presentation*
- ✓ *Raise the interest, I am sure this area has much more than a trainer may initially perceive*

THE MODULES NEED TO BE FLEXIBLE AND ADAPTABLE TO THE LEARNER

- ✓ *Being able to elect the modules/units most interesting for me*
- ✓ *Being flexible and adapt to my timings and availability*

INTERESTING IN TERMS OF INCREASED EMPLOYABILITY

- ✓ *Useful for future professional perspectives*
- ✓ *Information on how important is this theme not only for teachers but for the professional future of the students: connect it with the professions they will have and introduce examples*
- ✓ *First, I would like to better understand why it is important to my trainees and how they can use it in their lives (both personal and professional as I believe this issue affects both)*

Suggestions for the DUCK team

You can find below a word cloud we have made introducing all the replies. The most selected words were: *attractive for teachers and learners, short and focused, flexible, practical (connected to real life) and connected to teachers and students' needs:*

- ✓ *Be practical and get focused*
- ✓ *Make it very easy to understand, practical and focused for teachers and professors (what's in it for me?)*
- ✓ *Make it flexible, time is an issue for many educators nowadays*
- ✓ *Make it practical, use case studies, articles, info graphics...etc.*
- ✓ *Connect it with the actual needs of the labour market for teachers and students to understand its relevance*



- ✓ Connect it to real life
- ✓ Make it simple to follow, with real life examples and it tools to help teachers
- ✓ Make it flexible, easy to understand and follow. If i clearly see the benefit, then i am in
- ✓ "Sell it" to teachers and educators, for example: do your students have trouble understanding and presenting simple data sets?... Then this course is for you!
- ✓ Try to attract the audience (teachers) from the beginning: put yourself in "our shoes". We are overloaded with "new" courses every day, with bureaucratic compliances and requests...
- ✓ Use info graphics and interesting tools to make it more connected to my needs
- ✓ It is important to adapt it to the teachers' needs: we, as teachers, have lots of pressure from everywhere and little time available
- ✓ Make it concise, attractive, interactive, and very practical and address common needs of teacher training that currently is not part of the initial training.
- ✓ Practical and with introduction to gamification
- ✓ That it is not too long and that it can be adapted to the learning needs of the students
- ✓ Make it modular and progressive
- ✓ Make it participatory, attractive, and useful
- ✓ Short and entertaining, with real life examples, articles from press ... Etc.
- ✓ Reality-based. Short and attractive
- ✓ Connect it to the world, introduce real life scenarios and examples, make it attractive, catchy and interesting
- ✓ It is key to get close to problems today's teachers face and make cases where they can learn and apply to their class
- ✓ Make it short, focused, interesting for trainers and close to reality
- ✓ Make it online and very close to reality
- ✓ Make it flexible and adapted to the needs of the trainers
- ✓ Make it with and for teachers and trainers
- ✓ Bear in mind nowadays interests of trainees
- ✓ I do not have that much time so i would need the course to be flexible and accessible from different devices (tablet, phone...etc.)
- ✓ I am not very knowledgeable on this area....
- ✓ Make it flexible, close to real problems and attractive



Note: word cloud made using Tagxedo.



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3.4 POLAND

In Poland 30 responses were obtained, extracted during the months March-June 2019. We will include here below a summary of the profile of the respondents, followed by the results regarding the skills the students should get, the choice of media and methods.

Profile of the respondents:

GENDER	AVERAGE AGE	LENGTH OF SERVICE AS EDUCATOR / TEACHER	FIELD/SECTOR	AGE OF STUDENTS	SIZE OF THE CLASS
15 female	43,8 years old of average	16 years as average	24 HE	3 respondents: Below 15	3 respondents: < 10
14 male			1 Secondary education	1 respondent: 15-19	13 respondents: 10-15
1 prefer not to answer			1 Training of trainers	26 respondents: 20-25	13 respondents: 16-20
			2 VET	11 respondents: 25-30 or older	15 respondents: 21-25
			2 Primary education		6 respondents: 26-30
					6 respondents: > 30 pupils

The average respondent is a 44 year old woman with 16 years of experience. We have mostly representatives from Higher Education, but expertise in VET, secondary education, primary education and training of trainers are also presented. The average age of the students is 15-25 and the size of the class is 10-25 students per class.

Choice of skills the students should get

Participants were asked to rate a set of skills according to *1 definitely agree to 5 definitely disagree*. We can see below the results, which show that **all the Polish respondents AGREE on all the proposed skills**:

SKILLS	AVERAGE
Be able to inference important and interesting conclusions from data analytics	1,2
Be able to visualize results in simple and nice form	1,3
Be able to formulate the best possible questions in order to look at data from appropriate perspective	1,5
Be able to use popular tools (like MS Excel) to identify the most important features of data sets	1,6
Be able to prepare massive amount of data for analysis (cleaning data, etc.)	1,6
Be able to efficiently communicate conclusion in a "human" language (e.g. storytelling)	1,7
Be able to identify typical reasoning and interpretation pitfalls, basing on cognitive psychology discoveries	1,7

Other:

- *Statistical analysis of data*
- *Data integration*
- *Putting research hypotheses in such a way that the collected data make sense.*
- *The use of collected data and applications in the professional work*
- *Ability to work with databases and the ability to use data analysis software*
- *Get to know the package of tools and methods useful in the analysis and visualization / reporting of analysis results*
- *graphical presentation of data*

Choice of Media and Educational Materials

MEDIA AND EDUCATIONAL MATERIALS	AVERAGE
Open educational resources (OER)	1,6
Learning platforms	1,7
INFOGRAPHICS	2,0
ANIMATED PRESENTATIONS	2,0
Audio and video files	2,1
Internet link lists	2,4
PRINTABLE WORKSHEETS	2,6
Slides for overhead projector	2,6

So we can see that the preferred media and materials are:

- Open Educational Resources (OER)
- Learning platforms

Other:

- *Worksheets but in electronic version*
- *Teaching / training materials with a description of functionality, embossed issues and concepts in Polish*
- *Audiobooks and podcasts*
- *Statistical databases, press databases*
- *Simulation games*
- *Handbook*
- *A script with the most useful analysis tools*
- *Examples*

Choice of Methods

METHODS	AVERAGE
STORIES AND CASE STUDIES	1,6
DATA REPORTED BY NEWS MEDIA (NEWSPAPER, TV, RADIO)	1,8
Frontal instruction	1,8
SELF-LEARNING	1,9
GROUP WORK	1,9
EVERYDAY LIFE PROBLEMS	2,1
Role playing	3,1
Storytelling	3,1



Other:

- *step by step paths*
- *analysis of the results reported by other scientists - in terms of their objectivity*
- *interpretation of scientific or popular science reports*
- *critical analysis of existing analyses, abbreviations, logic abuse etc.*
- *working on an example*
- *the ability to independently solve a task that would be checked by the "system"*

Time, Preferences and Concerns

Regarding the **TIME THAT COULD BE DEVOTED TO THE COURSE**, most of the respondents (11) replied they could devote 10-15 hours, 8 less than 10, and 2 groups of 6 people would spent 16-20 hours or even more than 25 hours.

Regarding their **CONCERNS ABOUT THE COURSE**, most responders pointed out the content of the course and subject that will be covered. For example they are worried about:

- ✓ *the course will be too simple and trivial, and therefore it will not be interesting*
- ✓ *That it will be pouring water, not adapted to their needs*
- ✓ *the content will not be understood and adapted to the participants' perceptions (language too specialized)*
- ✓ *That it will contain too much mathematics and science of technological tools*
- ✓ *that the course will be prepared on examples with data processing software that they do not have access to*
- ✓ *it will contain few useful examples and analysis tools*
- ✓ *once again it will be a course from Excel*

Another issue is the teacher/trainer who will prepare and lead the course. Responders were worry that he or she *will not be an expert in this field, will not be able to convey this knowledge in an interesting and practical way.*

Few person was also concern about organisational part of the course (*too big groups or inconvenient time*) and about their personal matter like *lack of time.*

As to the question "What would make a course on Data Understanding and Communication INTERESTING FOR YOU TO PARTICIPATE?", the respondents said about:

Content of the course

- ✓ *Program: thematic scope of the course*
- ✓ *Its good factual preparation.*
- ✓ *Embedding in the context of social issues.*
- ✓ *Possibility to develop data for the needs of making decisions and presenting a coherent combination of business and realities with theoretical issues*
- ✓ *Interesting IT tool with a large package of analytical techniques and tools for processing and distribution of analysis results. Exercise nature of the course and the opportunity to work during classes on large data sets.*
- ✓ *Practical course.*
- ✓ *Knowledge in the field of data processing and drawing conclusions from large amounts of data*

Trainer:

- ✓ *A suitable lecturer with extensive experience and knowledge in this topic.*

Organizational aspects of the course:

- ✓ *convenient dates of classes*
- ✓ *matching course hours*
- ✓ *attractive price and appropriate time*

Online version of the course:

- ✓ *Online availability*
- ✓ *possibility of receiving teaching materials in electronic form*
- ✓ *free access to the course at any time*
- ✓ *affordable form of the course*

Certificate

- ✓ *Certificate confirming participation*
- ✓ *Certificate confirming competence*

Sample of the course:

- *Inspirational, example lesson*
- *A convincing description and an attractive, condensed information and promotion material that attracts attention and creates a positive "first impression", e.g. a short film, a leaflet with a course program, etc.*

Suggestions for the DUCK team

You can find below suggestions and recommendations made by participants of survey:

- ✓ *Sampling and versioning of the course - depending on the target group*
- ✓ *Balance between the content of the course and the use of IT tools*
- ✓ *The course should be designed in the right order - database, problem, data processing, drawing conclusions, etc.*
- ✓ *After completing the course, you should have the opportunity to work on tools and the opportunity to benefit from substantive support.*
- ✓ *Include the database*
- ✓ *Enter in the topic and show the perspective of the recipient of the data report*
- ✓ *It would also be good to work on real, diverse data, taking into account not only statistical analyzes (or in a small part at all), but rather rules of inference and selection, which is the most important for the topic.*
- ✓ *description at the points of the entire research process along with the interpretation*
- ✓ *Link to interesting content which could be used: <https://help.qlik.com/en-US/sense/3.0/Content/Videos/Videos-understand-the-data.htm>*
- ✓ *use as many new and creative methods as possible*
- ✓ *This course should be aimed at a wider audience than just the teachers themselves. The target should be SE and HE students. This should be a material suitable for sharing on MOOC platforms.*
- ✓ *Add some inspirational content on cognitive psychology (how do we know and interpret the world?)*

- ✓ *Maybe these should be separated courses for different subject groups; otherwise a linguist would approach the data, for example a psychologist.*
- ✓ *It is crucial to reach a targeted group of recipients. The certificate of completion of the course may be an attractive incentive to take part in it.*
- ✓ *division into hour groups, e.g. 4 hours a day, not 8 hours a day*
- ✓ *Do it asynchronously*
- ✓ *The classes should be of a project and exercise nature and be carried out on real data sets about the trainer's characteristics.*
- ✓ *a lot of exercises, flexible time of classes, length of classes adapted to individual limitations in the sense of free keeping up with the course of the course*
- ✓ *the price must be low*



4. RESULTS OF THE FOCUS GROUPS

4.1 HUNGARY

PLACE	DATE AND TIME	PARTICIPANTS
Budapest University of Technology and Economics, Centre for Learning Innovation and Adult Learning	24 June, 2019. 14:00 - 16:00	7 participants

The BME team has been carrying out a continuous communication about the DUCK project and its aim within its institution (reaching out to University management and different faculties with lecturers and researchers involved in work with data) and in its immediate professional network of relevance (Department of Education - former Ministry - of Hungary, network of quality managers).

The involved experts were invited to participate in the questionnaire, interviewed or finally invited to the focus group meeting. Double involvements were kept to a minimum.

Targeted invitations were sent out in May and June with a doodle poll to decide on the best date to have the event. The date and time are the results of the experts' voting.

PARTICIPANTS

6 participants were gathered:

- ✓ Éva Berki,
- ✓ János Erdei
- ✓ Ferenc Tátrai
- ✓ György Molnár
- ✓ Roland Molontay
- ✓ Marcel Nagy
- ✓ Zoltán Szűcs (excused)

The group was led by Dénes Zarka, additional support and note taking was done by Eva Szalma.



The language of the event was Hungarian.

The voice recording of the meeting is available on the DUCK project GDrive (duckfokus.wav)



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SUMMARY

The session started with a presentation of the participants and profiles. Introduction to the participating organisation, distribution of tasks within the project, the different expertise partners provide for the final aim.

Introduction of the background of the project: logical arguments and questioning, communicating knowledge (and data), understanding text and to be able to analyse everyday situations are more and more sought after as can be seen by diagnostic exams of big universities in the US (legal and medical faculties). The professional value of social skills is constantly growing.

The introduction was followed by a presentation (in Hungarian) of the project and the results of the survey.

Then the questions were posed:

- **Analysing the preliminary proposed 3 modules; Problem analysis, Data analysis, Data communication, could you give us your opinion regarding their relevance? Would you replace any?**

Partners agreed in general with the modules, the idea of a resource center and the methodology proposed. However when the level targeted by the DUCK development was discussed, participants believed that the level 3 (Given questions, identify datasets, choose appropriate methods and solve the problem) was more complex than the level 4 (identify questions, choose datasets and answer questions).

They proposed a possible switch of the two.

It was also not clear for them, how these levels relate to the methodologies proposed as they seem incoherent to one another.

Are the number of modules and their content sufficient for reaching the goal? Details of the modules and the types of assignment were shown.

They were very clear about the needs of the target groups, namely the school managers and business managers. Participants have proposed and clarified the following:

- ✓ To add trends and clusters as topics to the content (to 2nd module)
- ✓ One cannot start to understand data and be able to communicate it without some basics in statistics (primary/secondary data, quantiles, and correlation). Mathematical skills are not enough, as data has information content, numbers don't.
- ✓ Statistics, even on a basic level can be discouraging, need to take some assessment, measurements (e.g. competence assessments, or statistical data regarding their line of work), that they are familiar with and use deduction to arrive to the statistical concepts and rules.
- ✓ It is of crucial importance to have learners use the basic terminology correctly.

- ✓ At present, teachers and school managers are not able to make sense of national competence assessment or the PISA assessment. The PISA assessment reflects this “new” trend of re-evaluation knowledge and skills.

Proposed modules:

1. Databases, data understanding, data validation, data protection
2. Data analyses
3. Data communication

The course structure regarding methodology would look like this ideally:

1. F-2-f meeting
2. Self-learning
3. Discussing the results of self-learning, peer learning
4. Self-learning
5. f-2-f meeting

- **As to skills the students should get:**

Regarding the tools that the learners should learn to use, experts agreed that xls should be enough as most users are not aware of its potential.

More complex applications and business applications would require a longer course. Interviewees also expressed the need for learners to learn the principles of data understanding and communication rather than to rely on ready-made tools.

Recommendations can be made during the course, especially regarding data communication.

- **Choice of media:**

Experts agreed with the survey results that digital learning materials should be the main choice of media for the courses.

- **Choice of methods:**

Experts also agreed with the survey results concerning methods. It is important that the learning materials have a strong relevance to everyday problems.

Additional methods they suggested:

- ✓ debate
- ✓ Project work (it also replicates the work environment in many cases) vs. group work
- ✓ Cooperative methods
- ✓ Cross examinations of problems
- ✓ Case studies and assessments that they have to do in their line of work (eg schools yearly assessment) should be part of the examples
- ✓ Understanding the meaning of national (OSAP, KSH, Electra) and international statistics (CEDEFOP, UNESCO, OECD)



What would make a DUC course good and engaging?

- ✓ If they could bring their own problems from work to work on (NB trade secret information, data protection etc.)
- ✓ School representatives could bring their own PISA results
- ✓ If the level of skills aimed is clear!

All agreed that it is of utmost importance that the level of skills is properly addressed. Who are the main target group? What is the existing competence level of our main target group?

Also, there are no homogeneous groups, thus learning paths should be defined to accommodate the needs and competences of the learners.

Solutions could include

- ✓ defining the minimum digital competence to use the modules
 - ✓ initial assessment of existing level of DUC knowledge
 - ✓ clear description of competences to acquire in each lesson
 - ✓ clear description of which? existing knowledge or tests etc. are necessary to proceed
 - ✓ self-controlling options throughout the modules
- **Do you know of good practices regarding Data Understanding and Communication in the frame of Continuing Professional Development (CPD), Vocational Education and Training (VET) and Higher Education (HE) in your country or at EU level?**

There are courses that target potential data scientists, not the general public.

Potentially the topic could be present in Continuous training for educators and school managers.

The DUC course has the potential to be part of the BME PhD program (it would be a useful training for PhD students who have to do empirical research), also to be accredited as continuous professional training.

4.2 ICELAND

PLACE	DATE AND TIME	PARTICIPANTS
Bifröst University, Baula meeting room	29/08/2019 from 13:00-14:00	4 participants

Participants, with expertise related to the topic, were invited to participate, and the final group of four included two from within Bifröst University, one of them part of the academic staff and the other from the office of academic services. Two external experts took part both have experience in teaching mathematics or related subjects at university level. And both currently hold positions in applied research.



Participants

- Árni Sverrir Hafsteinsson
 - Director of the Icelandic Centre for Retail Studies
- Guðrún Björk Friðriksdóttir
 - Project manager for LMS systems at Bifröst University
- Josef Rebenda, Ph.D.
 - Assistant Professor at Brno University of Technology
 - Junior Researcher at CEITEC BUT (Central European Institute of Technology)
- Jón Freyr Jóhannsson
 - Adjunct professor at Bifröst University

After a brief introduction to the DUCK project, the meeting's objectives were outlined. Discussions were organized in four sections, followed by a final session for general thoughts and recommendations. For each of the four main rounds, participants were introduced to findings from surveys already conducted by the consortium and were then asked to elaborate on these findings.

- **Skills that students should acquire**

After reviewing the survey findings, it was suggested that the topic of cleaning data was surprisingly low on the list and is perhaps underestimated. Same can be said about analyzing the data. However, it was pointed out that analyzing and visualizing data may be what the student wants to do. By cleaning the data, one starts looking at the bigger picture and it's a good precursor to the analysis phase, but cleaning the data may be less rewarding, and so it gets a lower score. When you start a course on data analytics, data cleaning may not be what you had in mind, but it is such an important step in the process.

For the lower scoring items in the survey, the one on identifying typical reasoning and interpretation pitfalls was judged promising by the focus group. It could be a special trait of the module that makes it even more interesting.

Regarding tools to be used in a module, all agreed that Excel is very important. It is well known, most data is delivered in Excel now-days. One needs a stronger theoretical background to start using more sophisticated tools, something like R.

- ✓ Emphasize data cleaning as it is important and underestimated
- ✓ Use MS Excel
- ✓ Examining pitfalls and fallacies is a good way to learn

- **Choice of media**

From the survey, there were three items tied for first place. Having students make infographics could be instructional.

It was noted that at Bifröst University, a lot of videos are used and various mixed methods. Text as well.

Other than that, the results did not seem surprising. Overhead projectors are a thing of the past, and printable worksheets do not seem feasible.

The conclusion of a short discussion was that the use of audio/video delivery is good, and that infographics are an under-utilized technique that may be valuable for the student.



- ✓ Good to rely on recorded video lectures for delivery of key concepts and techniques
- ✓ Infographics add a new dimension to the traditional data/statistics course

- **Choice of methods**

At Bifröst University there is a strong emphasis on group work, which this survey also confirms as an appropriate choice. For choice of methods the focus group agrees with relying as much as possible on real data found in media or other open sources, so they would have ranked “Data reported by news media” higher. Storytelling could be a good choice, a method that is not so often used in courses but gives relevance to the work of the student.

Using lectures to some extent is perfectly fine, but this module should overall be “learning-by-doing” so its OK to start with some lectures, but those should not be the core of the course material

- ✓ Group work is good to keep students engaged and help them with exploring new methods
- ✓ Learning-by-doing

- **The DUCK model**

The model is good, with increasing complexity. It was suggested that level 3 and 4 is akin to master’s level thesis and level 4 even like phd, so it seems a bit too involved for what should be a compact learning-by-doing module with little theoretical underpinning. But Level 4 could still be a teaser for lower level students, good for exploring and generating ideas. Level 4 is good for students to see what’s ahead if they pursue a research track in social sciences, humanities etc., students need that experience. Level 4 should be approached with online platform and discussion, in order to keep the workflow going, otherwise students are likely to get stuck.

- ✓ The model is good and the lower levels are right and appropriate for the module
- ✓ Level 3 and 4 should preferably be approached by groups and discussion settings for exploring

- **Other sources of DUC material**

<http://www.procivicstat.org> (Erasmus project)

and other work of Professor Joachim Engle of Pädagogische Hochschule Ludwigsburg.

<https://codap.concord.org/about/> (Free open source software for data analysis built for use in schools.)

4.3 SPAIN

PLACE	DATE AND TIME	PARTICIPANTS
Adobe Connect – DUCK - BME	30/05/2019 from 10.55 to 12.05	8 participants

The invitation was sent at the beginning of the month of May. The session finally took place 30/05/2019 from 10.55 to 12.05 at Adobe Connect. Link to the session: <https://mti-bme.adobeconnect.com/pivz851j8haf/>

8 Participants were gathered:

- ✓ Graci Mir – Pedagogy and Human resources specialist
- ✓ Daniel Roig – Administration and innovation specialist
- ✓ Eduardo Linares – Project manager - Learning Innovation specialist
- ✓ Carmen Godino – Secondary School teacher – labor field
- ✓ Lucía Fernandez - Secondary School teacher
- ✓ Natividad Polonio - Secondary School teacher – economy
- ✓ Ismael Castro – Secondary School teacher
- ✓ Rosa Maria Martínez - Higher Education professor – accountability and economy.

The session started with a presentation of the participants and profiles. It was followed by a short presentation (in Spanish) of the project and the results of the survey.

Then the questions were posed:

- Analysing the **preliminary proposed 3 modules**: Problem analysis, Data analysis, Data communication, could you give us your opinion regarding to their relevance?. Would you replace any?

All the participants considered them relevant and adapted to the theme. The possibility to make them flexible and to be adapted to the knowledge of the learner was proposed. In this frame it was proposed to issue a self-assessment positioning questionnaire for the learner to start the learning from the right place.



- As to **skills the students should get**:

After the presentation of the results of survey and interviews, they expressed their agreement with the importance of them all. They suggested that the last one *“Be able to identify typical reasoning and interpretation pitfalls, basing on cognitive psychology discoveries”* is the most difficult and it is more linked to critical thinking. They agreed with the need to acquire these skills in the most practical way.

- Choice of **media**:

All the media (but the *overhead projector*, not available in Spain anymore) were considered relevant. For the HE professor, the use of excel was considered most important as the students were showing gaps in its use. For the secondary school level, the teachers expressed their concern in using some of the Office package tools due to restrictions. It was mentioned that there were “open office” available tools nowadays that could be suggested to be used.

- Choice of **methods**:

After the presentation of the results of the survey and interviews, enriched with the latest proposal for the organization of modules, it was presented that the 3 modules would follow a 4 LEVEL approach enriched with data and exercises. The recommended 4 modes were also considered very appropriate. They commented that it would be interesting to facilitate at the 4th level, the online discussion in ENGLISH to the learners participating from all the countries (HU, ES, PO, IS).

level	Data	Questions	Explanation
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Given data solve the problem (answer simple questions about data)
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Given data, suggest questions and answer them
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Given questions, identify datasets, choose appropriate methods and solve the problem
4	<input type="checkbox"/>	<input type="checkbox"/>	Identify problem, choose datasets and answer questions

Recommended mode of learning in relation to DUC area:

Recommended mode	Problem formulation	Data collection	Data analysis	Data communication
self-learning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
self-learning + discussion online	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
self-learning + discussion online	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
groupwork and discussions F2F	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

- Do you know of **good practices** regarding Data Understanding and Communication in the frame of Continuing Professional Development (CPD), Vocational Education and Training (VET) and Higher Education (HE) in your country or at EU level.

In English, the MIT open access courses were mentioned:

- <https://ocw.mit.edu/resources/res-6-009-how-to-process-analyze-and-visualize-data-january-iap-2012/>
- <https://ocw.mit.edu/courses/sloan-school-of-management/15-075j-statistical-thinking-and-data-analysis-fall-2011/>

Together with (in ES):

- [ANALISTA DE DATOS BIG DATA – CLOUDERA: https://www.emagister.com/analista-datos-big-data-cloudera-cursos-3418375.htm](https://www.emagister.com/analista-datos-big-data-cloudera-cursos-3418375.htm) GRATIS
- [TABLAS DINÁMICAS Y ANÁLISIS DE DATOS E HIPÓTESIS CON EXCEL: https://www.udemy.com/analisis-de-datos-e-hipotesis-con-excel-2013/](https://www.udemy.com/analisis-de-datos-e-hipotesis-con-excel-2013/) CUESTA 10,99€
- [PROGRAMA SDE ANALISIS DE DATOS PARA LA TOMA DE DECISIONES https://www.coursera.org/specializations/analisis-datos](https://www.coursera.org/specializations/analisis-datos)



4.4 POLAND

PLACE	DATE AND TIME	PARTICIPANTS
Faulculty of Management, WUT, Warsaw	28/06/2019 from 12.30 to 14.00	8 participants

The invitation was sent at the beginning of June. The meeting finally took place 28/06/2019.

Participants:

- ✓ Dr hab. Inż. Anna Kosieradzka
- ✓ Dr Marta Kruk
- ✓ Dr inż. Grzegorz Kunikowski
- ✓ Dr hab. Inż. Katarzyna Rostek
- ✓ Dr Lidia Sobczak
- ✓ Dr Małgorzata Waszkiewicz
- ✓ Dr inż. Michał Wiśniewski
- ✓ Dr hab. Andrzej Wodecki



After a short introduction by each participant the session started with a presentation of the project and the concept of the course made by Dr hab. Andrzej Wodecki.

Then the three questions were posed, which structured the discussion, namely:

- What would be the best possible activities in such a course, that you would like to use it in your lessons?
- What would be the best possible range?
- What other recommendations do you have?

After a lively discussion, the following conclusions were formulated:

- In order to avoid the dissonance associated with the diversity of: i) the digital competences of the teachers using the course, ii) the category and level of knowledge of the students of the course; it is recommended that both profiles should be carefully defined, i.e. the listener's profile (the scope of knowledge and competences held) and the profile of the graduate. The profile of a graduate can be determined using the triad: skills, knowledge and competences.
- It is recommended to distinguish two parts of the course:
 - a problematic (problem centered or problem-based?) part, which consists of formulating the problem, defining questions, defining goals and their measures, and then assessing the achievement of these goals based on the analytical data obtained,



- a technical part, showing how to identify data, integrate it for analysis, carry out analysis and develop and present its results.
- The importance of case studies and the search for analogies increases, which results from the fact that mass quantitative analyses are not reliable, because it is increasingly difficult to collect reliable data in large numbers and with unchanged ambient conditions. And if this is a problem, it is also a problem to guarantee the quality and reliability of the results of these analyses.
- The presented areas, consistent with the DUCK project objectives, i.e. data analysis, decision making and communication, are separate areas. The combination in the form of structural connections is both necessary and requires high skills from the listener as well. This means that a course containing all three elements will be impossible and ineffective in implementation. In the business reality, completely different people are responsible for these elements / stages. Why, then, should training train them together?
- An alternative might be to develop a sequence of courses consisting of modules. This will allow for the implementation of the course components in the sequence layout, where the previous module prepares the listener for the next module.
- Assuming that we focus on the process of a logical causal sequence and justifications, and not on the technical development of data, the substantive division of the problem of critical thinking into three phases (problem formulation, analysis, presentation of results) is accurate. A certain standardization in the listed phases is recommended with the indication of obligatory elements (guaranteeing the effectiveness of analyzes) and optional ones (improving the effectiveness of analyzes).
- The ability to formulate a problem and goals, understanding the significance of indicators as a means of achieving analytical goals and the ability to formulate such indicators, even on the basis of the possessed data, is a serious problem recognized among Faculty of Management students.
- In business practice, however, a serious misunderstanding is the implementation of a complex and advanced analytical and reporting tool in an organization where no one can use it for real problems in order to effectively solve them. Then it becomes only a demonstration area for IT specialists.
- The course should include a basic / non-changeable part and an optional part.
- A certain alternative is the design of a set of methods, tools, approaches for use in the situation of the need to analyze data and present results. In this approach, the goal is not to develop a universal method for solving problems, but the record of methods and methods: asking questions, analyzing basic data and visualizing results.
- The data analysis should not be included in the course in a significant way, because it is an area itself expanded into complex tools and would fully extend the course beyond the reachability limits of the originally adopted goals. However, there should be an indication in the part concerning the analysis of available data that there is a rich set of methods and techniques that can be used. (Here you can think about developing such a repository that characterizes these methods and techniques as a separate project product)
- Emphasizing the importance of lack of primary and secondary education in the area of learning the logical, critical and analytical skills. This means lack of first-year students in the field of having basic skills in the basics of critical thinking. It is assumed that they are achieved, and in fact these skills are also missing at the second level of studies.

- The course could offer a generalized rule of conduct and a collection, repository of tools and approaches that can be approached as needed.
- The repository can be supplemented by certain learning paths assigned to the category of problems and decision situations. Such paths could consist of predefined profiles:
 - listener at the entrance, with given prerequisites and learning objectives,
 - profile of the course graduate with the list of obtained: knowledge, skills and competences.
- Difficulty grading is recommended, each stage should contain all elements at the same time (problem formulation, analysis, presentation of results) configured on a given difficulty level, not separately individual elements in the first level system - problem formulation, second level - analysis, etc.



5. PROPOSED CONTENT STRUCTURE OF THE IO2 COURSE

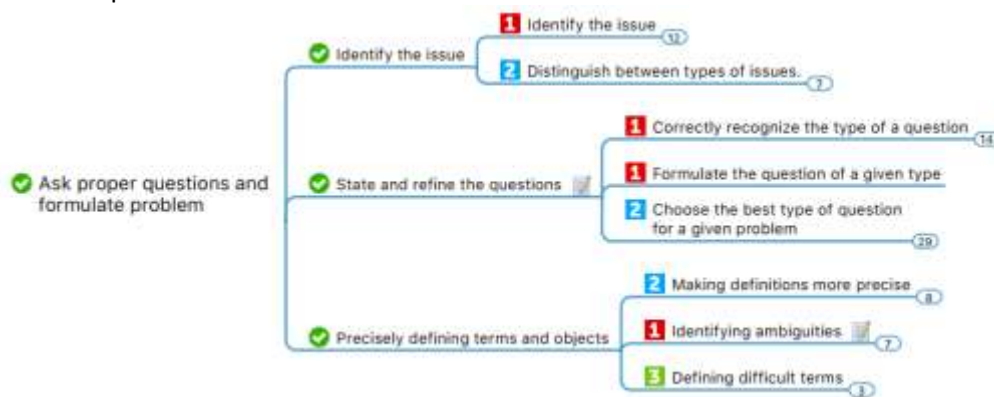
The IO2 **Data Understanding and Communication** course is proposed to be structured in 3 blocks:

1. **PROBLEM ANALYSIS:** How to ask proper questions and formulate problems
2. **DATA COLLECTION AND ANALYSIS:** How to collect and analyse data
3. **COMMUNICATION:** How to communicate your insights

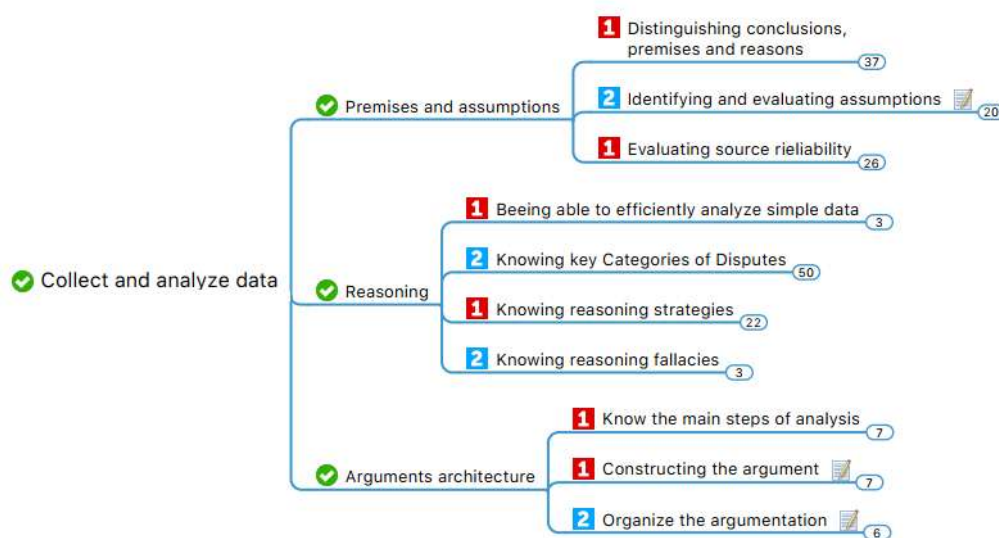
After the C1 activity implemented in Palma de Mallorca during 8 to 10 October 2019 a very intensive collaborative training exercise was implemented after the presentation of the preliminary results of IO1 in order to select the main contents of the course. The exercise included intensive training about the key issues to include in the course and a final voting about the most important contents.

The main results are included here below.

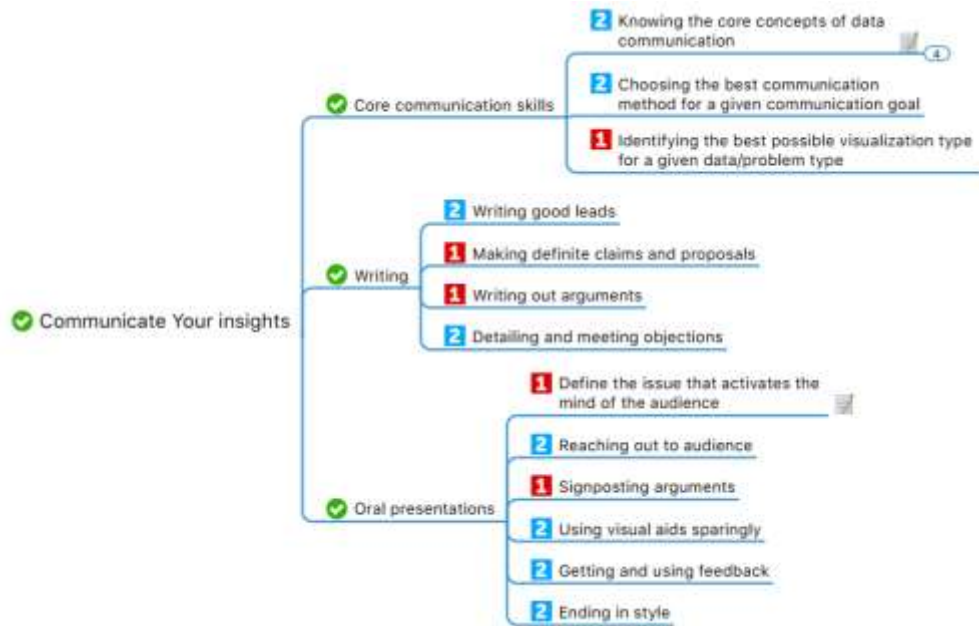
1. **PROBLEM ANALYSIS:** 1 reflects the most important followed by to be considered and not important:



2. **DATA COLLECTION AND ANALYSIS**



3. COMMUNICATION



The following table illustrates the selected content:

	UNITS	KEY ASPECTS	ALSO TO BE CONSIDERED
1. PROBLEM ANALYSIS	1.1 IDENTIFY THE ISSUE	1.1.1 Identify the issue	Distinguish between types of issues
	1.2 STATE AND REFINE THE ISSUE	1.2.1 Correctly recognize the type of question 1.2.2 Formulate the question of a given type	Choose the best type of question for a given problem
	1.3 PRECISELY DEFINING TERMS AND OBJECTS	1.3.1 Identifying ambiguities	Making definitions more precise

	UNITS	KEY ASPECTS	ALSO TO BE CONSIDERED
2. DATA COLLECTION AND ANALYSIS	2.1 PREMISES AND ASSUMPTIONS	2.1.1 Distinguish conclusions, premises and reasons 2.1.2 Evaluating source reliability	Identifying and evaluating assumptions
	2.2 REASONING	2.2.1 Being able to efficiently analyse simple data 2.2.2 Knowing reasoning strategies	Knowing key categories of disputes Knowing reasoning fallacies
	2.3 ARGUMENTS ARCHITECTURE	2.3.1 Know the main steps of analysis 2.3.2 Constructing the argument	Organise the argumentation

	UNITS	KEY ASPECTS	ALSO TO BE CONSIDERED
3. COMMUNICATION	3.1 CORE COMMUNICATION SKILLS	3.1.1 Identifying the best possible visualisation type for a give data/problem type	Knowing the core concepts of data communication Choosing the best communication method for a given goal
	3.2 WRITING	3.2.1 Making definite claims and proposals 3.2.1 Writing out arguments	Writing good leads Detailing and meeting objections
	3.3 ORAL PRESENTATIONS	3.3.1 Define the issue the activates the mind of the audience 3.3.2 Signposting arguments	Reaching out to audience Using visual aids Getting and using feedback Ending in style



6. SUMMARY AND CONCLUSIONS

Regarding the summary of desk and field research:

As regards, **policy level and practices**, there are no specific policies related to training or up skilling for teachers, trainers and university professors regarding specifically data understanding and communication in ANY OF THE countries researched. However, in Poland it is assumed that the graduate has the skills of critical thinking at Level 6 (BSc, Eng.) and Level 7 (Master), which corresponds to European Qualification Framework.

Continuing professional development of teachers and professors in the countries involved reflects that education authorities are responsible for planning, organising and recognising continuing professional development within their jurisdiction providing teachers with a wide range of activities.

In Hungary, there are courses that teach qualitative and quantitative methodologies: probability theory, statistical uncertainty, randomness is part of courses like technical management. Besides this, HE has general statistics in *Quality management and business statistics* programmes: there are 14 BSc programs and 6 MSc programs. Quantitative statistics are taught in average 4 classes per week, qualitative analyses belong to the quality management classes. The Educational Authority employees at present attend a course on data visualisation, using Power BI by Microsoft that is the most widespread app for data visualisation, usually used by the industry. Their 50 hour course however was open to people with specific background (analysts, colleagues working with big data, ICT people).

In Iceland, Continuing Education University of Iceland is the biggest provider of continuing education courses in Iceland and offers a wide range of courses and study programs. By a review of the course offering, four courses were identified, that specifically covered communication of quantitative data. Three of them, were courses in using Microsoft Excel, at incremental levels of complexity, while the fourth was a course on Microsoft Power BI.

In Spain, continuing professional development activities consist of regular actions for the updating of their scientific, educational and professional expertise. Participation is voluntary. Priority guidelines for 2018 (ES Ministry of Education Culture and Sports, 2018) on continuing teacher training plans are annually established through the Spanish Institute for Education Technologies and Teacher Training (INTEF) but do not include Data Understanding and Communication related contents.

In Poland, in the field of CPD the educational offer in the field of data analysis and presentation offered either by training companies and universities is rich and varied in terms of content and level.



- **Summary of the results of the survey , interviews and focus group**

HUNGARY: the key tips emerged include, among others:

- ✓ Try to include many graphs, algorithms, good examples are key to success
- ✓ Try to include Area-specific elements, e.g. analyses by industry
- ✓ A prior mathematical summary would be much needed.
- ✓ The approach should obviously be different for "IT teachers" (who are "data analysis experts") and for all other teachers (who are "technical experts"). For the former, it is really important to teach the primacy of the professional problem (a kind of humility to the "customer"), and for the latter, mastering the basics of "data science" so that they can effectively communicate with data analytics experts ').
- ✓ Possibility of online course participation
- ✓ Training needs to be accredited
- ✓ It is important to include a follow up of training

ICELAND: the key tips that emerged include among others:

- ✓ Being able to summarize and present data quickly
- ✓ Tackling real life problems as we see them in the workplace.
- ✓ To acquire training in using “gold standard” software and ensuring that the topics are relevant to specific study fields.
- ✓ Need to be able to understand first the relevant fundamentals and grow in complexity as the course runs.
- ✓ Need to have, from the beginning, a clear picture of the "end product"
- ✓ We need to understand the relevance of DUC teaching and learning.
- ✓ The importance of including real case studies: Analyse a large data set in a case study setting for example and how students can extract data with the right tools such as excel or other. Step by step application, critical thinking and creative thinking is important as well.

SPAIN: All the Spanish respondents agree on all the proposed skills and insist on the communication side, that is, not only prepare, use and formulate questions but also present results such as for example, make useful and understandable graphics. The preferred methods are printable worksheets, infographics and animated presentations. Regarding media: data reported by news media (newspaper, tv, radio), everyday life problems, stories and case studies, self-learning and group work were considered most important.

Regarding the time that could be devoted to the course, most of the respondents replied they could devote less than 10 hours, 6 of them said that between 10 to 15 hours.

Regarding their concerns about the course, again the time (that is the course being too long) and the attractiveness of the course were the 2 factors most commented by the respondents.

As to the question “*What would make a course on Data Understanding and Communication interesting for you to participate?*”, the respondents reported their concerns about:

- ✓ the little time they have:
- ✓ they need to see real life examples and a clear applicability with their students
- ✓ respondents need to perceive the benefit it will have
- ✓ the modules need to be flexible and adaptable to the learner
- ✓ Interesting in terms of increased employability.

POLAND: the key tips emerged include, among others:

- ✓ The course should be designed in the right order - database, problem, data processing, drawing conclusions, etc.
- ✓ Propose to work on real, diverse data, taking into account not only statistical analyses (or in a small part at all), but rather rules of inference and selection, which is the most important for the topic.
- ✓ Find a balance between the content of the course and the use of IT tools
- ✓ Be as creative as possible
- ✓ Think well of the audience: this course should be aimed at a wider audience than just the teachers. The target should be SE and HE students. If you think well about the audience, the material could be suitable for sharing on MOOC platforms.
- ✓ Think of adding some inspirational content on cognitive psychology (*how do we know and interpret the world?*)
- ✓ The certificate of completion of the course may be an attractive incentive to take part in it.
- ✓ Do it asynchronously
- ✓ Include a lot of exercises and flexible time of classes. Try to adapt the length of classes to individual limitations.

Teachers underlined that if the course will be interestingly designed, with good content and activities, regardless of the form, they would get involved. They must first see their interest: what will they gain from taking part in it? How will their classes with students become better after this course?

At the beginning, they would like to get preliminary information, which would justify why it is worth participating in this course. That would be a kind of pill that would involve them.

Implications for IO2: COURSE DEVELOPMENT

level	Data	Questions	Explanation
1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	Given data solve the problem (answer simple questions about data)
2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Given data, suggest questions and answer them
3	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Given questions, identify datasets, choose appropriate methods and solve the problem
4	<input type="checkbox"/>	<input type="checkbox"/>	Identify problem, choose datasets and answer questions

Recommended mode of learning in relation to DUC area

Recommended mode	Problem formulation	Data collection	Data analysis	Data communication
self-learning	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
self-learning + discussion online	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
self-learning + discussion online	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>
groupwork and discussions F2F	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

The 3 modules with 4 LEVEL approaches enriched with data and exercises were considered a very interesting approach. The recommended 4 modes were also considered very appropriate.

Maybe it would be interesting to facilitate at the 4th level, the online discussion in ENGLISH to the learners participating from all the countries (HU, ES, PO, IS).

It was recommended that difficulty grading could be encouraged: each stage could contain all elements at the same time (problem formulation, analysis, presentation of results) configured on a given difficulty level, not separate individual elements in the first level system - problem formulation, second level - analysis, etc.

As to the course structure, the respondents involved in the research mentioned the possibility to make the course flexible to be adapted to the knowledge of the learner. In this frame it was proposed to issue a self-assessment positioning questionnaire for the learner to start the learning from the right place.

Implications of your results for IO3 OER RESOURCE

According to the results of field research, we would suggest:

- Indicate clearly the time needed for each resource
- Make emphasis on real life examples and a clear applicability and adaptability to the contexts
- Make the learning as flexible as possible in order to be as adaptable as possible to the learner
- Try to reflect the benefit of the learning and the potential of increased employability

Implications for IO4 LLKIT AND GUIDELINES

We would emphasize the need of the Lessons Learnt Kit to try to reflect the audience to which the learning is addressed, the benefit of the learning for the different targets and the potential of increased employability.

Implications for IO5 ON-LINE RESOURCE CENTER AND LEARNING PORTAL

The words that were most used by the participants in the interviews, survey and focus group were: (make it) *attractive for teachers and learners, (keep it) short and focused, (try to be) flexible, (make it) practical and connected to real life, and connected to teachers and students' needs.*



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