Deliverable 4.1

University pilots report

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Responsible Organisation: UOM

Version-Status: V1 FINAL

Submission date: 31/12/2018

Dissemination level: PU

Disclaimer
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# Deliverable factsheet

<table>
<thead>
<tr>
<th>Project Number:</th>
<th>562604-EPP-1-2015-1-EL-EPPKA2-KA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Acronym:</td>
<td>ODEdu</td>
</tr>
<tr>
<td>Project Title:</td>
<td>Innovative Open Data Education and Training based on PBL and Learning Analytics</td>
</tr>
<tr>
<td>Title of Deliverable:</td>
<td>D4.1 – University Pilots Report</td>
</tr>
<tr>
<td>Work package:</td>
<td>WP4 – Education and Training activities</td>
</tr>
<tr>
<td>Due date according to contract:</td>
<td>31/12/2018</td>
</tr>
<tr>
<td>Editor(s):</td>
<td>UOM</td>
</tr>
<tr>
<td>Contributor(s):</td>
<td>UOM</td>
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<td>AAU</td>
</tr>
<tr>
<td>Reviewer(s):</td>
<td>ODI</td>
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<tr>
<td>Approved by:</td>
<td>All Partners</td>
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## Abstract:
The report presents preparatory work carried out for the implementation of the university pilots. More specifically, the report provides analytical descriptions of the process, including information such as the methodology followed, the learning methods and materials used, the duration of the pilots, practical applications, engagement learning methods etc.

The report also describes events that took place where stakeholders participated to learn about Open Data and Open Data education.

## Keyword List:
Open Data university courses, PBL method, learning design
## Consortium

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<th>Name</th>
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<th>Country</th>
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<tr>
<td>1</td>
<td>Coordinator, academic partner</td>
<td>University of Macedonia</td>
<td>UOM</td>
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<td>2</td>
<td>Open Data expert</td>
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<td>ODI</td>
<td>UK</td>
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<td>Problem Based Learning expert</td>
<td>Aalborg University</td>
<td>AAU</td>
<td>Denmark</td>
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<td>Technology enhanced learning expert</td>
<td>AcrossLimits</td>
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<td>SEPVE</td>
<td>Greece</td>
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<td>6</td>
<td>Open / Linked Data technologies expert</td>
<td>ProXML</td>
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# Revision History

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<td>V01</td>
<td>11/09/2018</td>
<td>UOM</td>
<td>UOM contributions on first trials added</td>
</tr>
<tr>
<td>V02</td>
<td>26/11/2018</td>
<td>AAU</td>
<td>AAU contributions on trial added</td>
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<tr>
<td>V03</td>
<td>07/12/2018</td>
<td>AAU</td>
<td>AAU contributions on learning activity added</td>
</tr>
<tr>
<td>V04</td>
<td>08/12/2018</td>
<td>UOM</td>
<td>UOM contributions on events added</td>
</tr>
<tr>
<td>V05</td>
<td>13/12/2018</td>
<td>UOM</td>
<td>First complete version sent to partners</td>
</tr>
<tr>
<td>V1</td>
<td>27/12/2018</td>
<td>UOM</td>
<td>Final version ready for submission</td>
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</table>

## Statement of originality:
This deliverable contains original unpublished work except where clearly indicated otherwise. Acknowledgement of previously published material and of the work of others has been made through appropriate citation, quotation or both.

## Disclaimer
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## List of Abbreviations

The following table presents the acronyms used in the deliverable in alphabetical order.

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<th>Abbreviation</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>ICT</td>
<td>Information and Communication Technologies</td>
</tr>
<tr>
<td>MOOC</td>
<td>Massive Open Online Course</td>
</tr>
<tr>
<td>LA</td>
<td>Learning Analytics</td>
</tr>
<tr>
<td>PBL</td>
<td>Problem Based Learning</td>
</tr>
<tr>
<td>RDF</td>
<td>Resource Description Framework</td>
</tr>
<tr>
<td>WP</td>
<td>Work Package</td>
</tr>
</tbody>
</table>
Executive Summary

This report elaborates on the preparatory work carried out for the implementation of the university pilots. Moreover, the report provides analytical descriptions of the process, including information such as the methodology followed, the learning methods and materials used, the duration of the pilots, practical applications, engagement learning methods etc.

The report also elaborates on events that took place and where academic stakeholders participated. Such events include datathons, workshops for the public sector and a MOOC for Open Data open for any interested stakeholders. Other such events were also carried out by the VET partners and University partners targeting business and public sector employees, as described in D4.2. The following Table provides an overview of the pilots and events that have been completed, are currently running or are scheduled to start after the project’s end.

Table 1 Overview of University pilots and events

<table>
<thead>
<tr>
<th>Main partner</th>
<th>Activity description</th>
<th>Status</th>
<th>Target groups</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAU</td>
<td>Open Data Crash Course</td>
<td>Complete</td>
<td>Uni students</td>
<td>8</td>
</tr>
<tr>
<td>AAU</td>
<td>Social science students in eGovernment and innovation</td>
<td>Complete</td>
<td>Uni students</td>
<td>30</td>
</tr>
<tr>
<td>AAU</td>
<td>Two online modules aimed at Danish municipality employees</td>
<td>In progress</td>
<td>Municipality employees</td>
<td>Ongoing</td>
</tr>
<tr>
<td>UOM</td>
<td>Advanced Information Systems (BSc course)</td>
<td>Complete</td>
<td>Uni students</td>
<td>9</td>
</tr>
<tr>
<td>UOM</td>
<td>Management Information Systems</td>
<td>In progress</td>
<td>Uni students</td>
<td>238</td>
</tr>
<tr>
<td>UOM</td>
<td>BSc eGovernment</td>
<td>Complete</td>
<td>Uni students</td>
<td>16</td>
</tr>
<tr>
<td>AAU</td>
<td>PBL model tutorial video</td>
<td>Complete</td>
<td>Everyone</td>
<td></td>
</tr>
<tr>
<td>UOM</td>
<td>MSc Innovative Systems for e-Business</td>
<td>Complete</td>
<td>Uni students</td>
<td>5</td>
</tr>
<tr>
<td>UOM</td>
<td>Participation in MOOC</td>
<td>In progress</td>
<td>Everyone</td>
<td>handfuls</td>
</tr>
<tr>
<td>UOM</td>
<td>EGOV tutorial</td>
<td>Complete</td>
<td>Everyone</td>
<td>6</td>
</tr>
<tr>
<td>UOM</td>
<td>Datathon</td>
<td>Complete</td>
<td>Uni students</td>
<td>6</td>
</tr>
<tr>
<td>UOM</td>
<td>MSc “IT and Law” course</td>
<td>Complete</td>
<td>Uni students</td>
<td>10</td>
</tr>
<tr>
<td>UOM</td>
<td>2nd datathon</td>
<td>Complete</td>
<td>Everyone</td>
<td>23</td>
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<tr>
<td>AAU</td>
<td>Workshop about designing with data</td>
<td>Scoped</td>
<td>Uni students (master in service systems design)</td>
<td>30-35</td>
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All university partners intend to continue using the ODEdu’s outputs in their educational settings and host different events such as datathons and workshops in order to introduce Open Data to all interested stakeholders in academia, business and the public sector.
1 Introduction

The aim of this section is to introduce the background of the work pursued with Task 4.1 (M19-M36). Education activities. The scope and the objective that the current document has set out to achieve are presented in sub-section 1.1. The intended audience for this document is described in sub-section 1.2 while sub-section 1.3 outlines the structure of the rest of the document.

1.1 Scope

The presented document is the Deliverable 4.1 “University pilots report” of the ODEdu project and the first deliverable of WP4. The main objective of WP4 is to organize trial pilots with the participation of the project partners for maximum knowledge exchange and co-creation. More specifically, pilots will be held in university courses on Open Data for undergraduate and postgraduate students and / or events will be carried out for employees in the private sector and training activities will be carried out for public servants on Open Data lifecycles.

The present report aims to elaborate on the preparatory work carried out for the implementation of the university pilots. Moreover, the report provides analytical descriptions of the process, including information such as the methodology followed, the learning methods and materials used, the duration of the pilots, practical applications, engagement learning methods etc.

The report also describes events that took place and where academic stakeholders participated, e.g. hackathlons, workshops etc.

1.2 Audience

The document is for:

- Any interested stakeholders that aim to get involved in PBL-based education and training.
- The project partners.
- The European Commission.
1.3 Structure

The structure of the document is as follows:

- Section 2 presents the methodology followed.
- Sections 3 to 9 present the pilots performed by UOM and AAU.
- Section 10 presents education and training events hosted by the university partners (UOM).
2 Methodology

The university partners (UOM and AAU) followed the project’s outputs produced in order to prepare and report on the university pilots.

More specifically, a template was created for the homogenous documentation of the pilots and to make sure that they are designed taking into consideration all relevant project’s results (e.g. PBL model, OD_PBL design pathway, e-learning platform, Open Data curriculum, university course model).

The template and the sub-sections that need to be filled out are shown below.

University trials reporting template

2.1 Organization name: trial 1

This section aims to provide details on how each organisation designed and delivered each pilot. The information provided should be in accordance to the project’s results, i.e. the PBL learning model, OD_PBL design pathway and the University course model.

Provide a few initial details on the trial, e.g. organization, course name, previous experiences in teaching the same course, educational objectives, learning outcomes etc.

2.1.1 Trial 1 design

In the following sub-sections you should provide details on the decisions you made during the design of the course, to ensure alignment with the project’s pedagogical results (i.e. PBL model, OD_PBL design pathway).

2.1.1.1 Understanding

Provide details on the three following concepts i.e. context, content, time.
**Context**: Identify the trials’ participants (e.g. undergraduate students of Computer Science University, private employees, public employees of Municipality etc.). Identify organisation performing the trial (e.g. university, training organization, private company etc.).

**Content / Course objectives**: Record the general areas / categories of learning to be used per trial from the OD curriculum skeleton in D1.1, shown in the following Figure.
Time: How many days / weeks? How many hours per day / week?

Identify competencies

Consult D1.1 and the Open Data curriculum skeleton to record which Outcomes (skills and knowledge) were relevant for your trial. The following Table shows a small example.

Table 2 Course outcomes

<table>
<thead>
<tr>
<th>Outcome</th>
<th>EQF level</th>
<th>Skill / Knowledge (S/K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>what open data is</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>how to annotate my data so that they are correctly understood</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>more about data formats</td>
<td>3</td>
<td>S</td>
</tr>
</tbody>
</table>

2.1.1.2 Alignment with pedagogical principles

Record how you aligned your trial with the PBL pedagogical principles (meta and pragmatic), as shown in the following Figure. To this end, you need to map the PBL and LA tools you will use in your trial with each principle that the ICT tool supports.

Figure 3 PBL principles

A representative example:

Table 3 Mapping ICT tools with PBL principles

<table>
<thead>
<tr>
<th>ICT tool</th>
<th>PBL principle</th>
</tr>
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<tbody>
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</tbody>
</table>
2.1.1.3 Design

The design step is divided in four steps, namely: define the problem, generate learning activities, define assessment and check the design.

2.1.1.3.1 Define the problem

Here, document if the trial was designed based on:

a) a problem that requires solving,

b) contents that need to be taught and we use real problems for the learning process

c) a project which combines problem solving and content teaching.

2.1.1.3.2 Generate learning activities

In this step, present the activities that support the meta-principles, e.g. collaboration, critical thinking, reflection, etc. as well as the activities or resources that support the pragmatic principles, e.g. application, activation, integration, feedback.
A representative example of activities is:

- Lecturing: teachers provide brief information on the content in order to activate students’ interest and set the main knowledge basis for the work to be carried out (Activation).

- Research on existing datasets: research (Activation, Self-driven learning).

- Analysis of the datasets’ elements into individual concepts: notes taking (Self-driven learning, Activation, Reflection, Integration, Feedback).

2.1.1.3.3 Define assessment

In this step, create the alignment between learning outcomes, learning activities and evaluation. Decisions that you made for your pilot from the following alternatives:

- Type of assessment, e.g. employing formative, summative, or both. The PBL strategy encourages either formative evaluation or both formative and summative. The sole employment of summative evaluation is not usually suggested, as ongoing progress and performance of learners becomes difficult to monitor.

- Target of assessment, e.g. group or individual evaluation. Teachers could aim for a combination of monitoring the group as a whole as well as assessing the individual’s contribution to the learning outcomes and their comprehension of the materials, but also the PBL key aspects such as critical thinking, solving problems, etc.

- Timing and location of assessment, e.g. after the completion of each unit of learning, after the completion of a PBL step etc.
● Mechanisms of assessment, e.g. what types of instruments will be used for learners’ performance evaluation. Such instruments can include LA tools and visualizations that will provide insights on learners’ progress throughout the entire course.

2.1.3.4 Check the design

In this step, describe how you checked and made sure your decisions for the design of your trial were in line with our educational objectives. Questions that we usually ask ourselves in this step are: what kind of PBL am I applying? Is this problem related to real workplace problems? Are the learning activities, assessment and learning goals aligned? How does the design support the activation of previous knowledge? How does the design facilitate the application of new knowledge? How does the design facilitate the develop critical thinking, collaborative learning and reflection?

2.1.2 Trial 1 delivery

2.1.2.1 Delivery method and course structure

Describe the delivery method for the trial (online, blended). How many weeks compared to the 13 weeks suggested in the University course model. When and how were students given access to the content.

Describe the content actually used within the trial per week. Provide links and mention types of content (e.g. slides, PDF, interactive pages, SCORM packages etc.). An example:

Week 1: What is data (slides in Greek)

The main purpose of this week was to introduce students to the field and potential of data.

This week’s learning outcomes were:

[Knowledge] Define data science

[Knowledge] Define Open Government Data

2.1.2.2 The platform

Explain how the platform aided learning. Provide screenshots of the course from the platform, and explain how the decisions made during the design phase are shown in the delivered course. Provide information on the specific PBL and LA tools used.
2.2 Educational and training events

This section will provide feedback on any other educational and training events outside of the formal university course paradigm. Such events will include hackathons, webinars, seminars, workshops etc.

Provide information on how each event was designed and delivered. Describe the results and lessons learnt.
3  UOM trial “e-Government” BSc course

The following sub-sections include details on how the “e-Government” BSc course at UOM was re-designed and delivered based on the project’s results, i.e. the PBL learning model, OD_PBL design pathway and the University course model.

The “e-Government” course is an elective course and is taught at the 8th semester of the university’s curriculum. The course’s main subject fields included introduction to e-government and e-participation, e-government processes and policies and e-government tools. The course was taught in a traditional setting, i.e. we presented the lecture within the classroom and students were assessed during a final exam. During the previous two years, the topic of Open Data has been slowly incorporated within the course’s curriculum in order to introduce students to this newly emerging subject. The focus of the new subject was in open data as a new field, creating RDF data and re-using RDF data through SPARQL queries. This led to the gradual transformation of the course to a more interactive setting, where students started participating actively within the classroom and using tools to exploit existing data.

The re-design of the course with the incorporation of the ODEdu learning content led to the specification of the following learning objectives:

- Understanding the role and the potential of utilizing information systems in Public Administration
- Using e-government and e-participation applications
- Developing simple applications based on open government data.

3.1  Trial 1 design

In the following sub-sections details are provided on the decisions made during the design of the e-government course, to ensure alignment with the project’s pedagogical results (i.e. PBL model, OD_PBL design pathway).

3.1.1 Understanding

The initial phase of the course re-design regarded the understanding of the course’s main elements.

3.1.1.1 Time

The course is taught one day a week for the 13 weeks of the academic semester. Each week, the course lasts 2 hours. A total of 24 hours were dedicated to delivering the course.
3.1.1.2 Context

The trial was carried out in the context of the “electronic Government” course taught at the Applied Informatics department of the University of Macedonia. The course is part of the 8th semester’s curriculum and regards topics such as e-government data, e-government processes and policies.

During the trial, 16 students participated and formed four groups of four.

3.1.1.3 Content

The course’s content focused on Linked and Open data, re-using ODEdu material from the categories of the project’s curriculum such as:

- Culture
- Academic practice
- Presenting data and
- Advanced technical skills.

More specifically, Table 1 shows the specific units of learning that were included from each curriculum category. These units of learning included content from the learning material created by ODI and from previous learning material created by UOM in the previous academic semesters.

Table 4 units of learning for e-government course

<table>
<thead>
<tr>
<th>Culture</th>
<th>Value of open data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Creating innovation with data</td>
</tr>
<tr>
<td></td>
<td>Open standards</td>
</tr>
<tr>
<td>Academic practice</td>
<td>Metadata and annotation</td>
</tr>
<tr>
<td></td>
<td>Legal issues, licensing, ethics</td>
</tr>
<tr>
<td></td>
<td>Data formats</td>
</tr>
<tr>
<td></td>
<td>Research data and innovation</td>
</tr>
<tr>
<td></td>
<td>Opening new business with open data</td>
</tr>
<tr>
<td>Presenting data</td>
<td>Data storytelling</td>
</tr>
<tr>
<td></td>
<td>Data journalism</td>
</tr>
<tr>
<td>Advanced technical skills</td>
<td>RDF graphs</td>
</tr>
<tr>
<td></td>
<td>SPARQL queries</td>
</tr>
<tr>
<td></td>
<td>Linked data</td>
</tr>
<tr>
<td></td>
<td>Vocabularies and schemas</td>
</tr>
</tbody>
</table>
**Identify competencies**

We consulted the D1.1 report in order to identify all the different competencies that the e-Government students would be able to gain with the participation in the course. Thus, we recorded all the different outcomes (skills and knowledge) that were relevant to the course based on the materials taught and the learning objectives. This documentation is shown in Table 5.

<table>
<thead>
<tr>
<th>Outcome</th>
<th>EQF level</th>
<th>Skill / Knowledge (S/K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>what open data is</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>State what makes open data open</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Explain the general process, lifecycle and potential of open data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Identify key impacts and benefits of opening up data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Name the economic benefits</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Describe where we expect Open Data to be of value</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Explain why to open up my research data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Explain how OD creates value</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Identify ways to engage with journalists and other relevant public</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>domain actors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Explain data licenses</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>how to annotate my data so that they are correctly understood</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>more about data formats</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>Identify different data formats</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>List existing Open Data portals</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Search an Open Data portal</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>Identify how Open Data is supporting growth by revealing opportunities</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>for businesses</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3.1.2 Alignment with pedagogical principles

After the specification of the context of the course and the identification of all the knowledge and skills that are relevant to the course, we proceeded to align our trial with the PBL pedagogical principles (meta and pragmatic). To this end, we mapped all the different PBL and LA tools that were chosen for use in our trial to each PBL principle that the tool supports. This mapping is shown in Table 6.

Table 6 Mapping of PBL principles with ICT tools

<table>
<thead>
<tr>
<th>PBL principle</th>
<th>PBL ICT tool</th>
<th>LA ICT tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem centered (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>Statistics</td>
</tr>
<tr>
<td>Collaborative learning (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td>Critical thinking (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td>Step Description</td>
<td>Tools and Features</td>
<td></td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>--------------------</td>
<td></td>
</tr>
<tr>
<td>Self-driven learning and reflection (meta)</td>
<td>Student folder Wiki Learning content (Files)</td>
<td>Analytics graphs GISMO Heatmap Course dedication</td>
</tr>
<tr>
<td>Activation (pragmatic)</td>
<td>Forum Learning content (Files)</td>
<td>Analytics graphs GISMO Heatmap Course dedication</td>
</tr>
<tr>
<td>Demonstration (pragmatic)</td>
<td>Quiz Feedback Assignment</td>
<td>Analytics graphs GISMO Statistics Quiz statistics</td>
</tr>
<tr>
<td>Application (pragmatic)</td>
<td>Feedback Assignment</td>
<td>Analytics graphs GISMO Statistics</td>
</tr>
<tr>
<td>Integration (pragmatic)</td>
<td>Wiki</td>
<td>Analytics graphs GISMO</td>
</tr>
<tr>
<td>Feedback (pragmatic)</td>
<td>Feedback</td>
<td>Analytics graphs GISMO</td>
</tr>
</tbody>
</table>

The above tools helped students execute all PBL steps within the e-learning platform, and helped teachers of UOM make sense of the students’ progress, their misconceptions and identify time for intervention.

### 3.1.3 Design

The design step is divided in four steps, namely: define the problem, generate learning activities, define assessment and check the design.
3.1.3.1 Define the problem

The course included one main group assignment, where each group was required to formulate, design, analyse, implement and assess a problem. This problem was defined as a project that combines problem solving and content teaching. Students were required to study the learning material on open data, open data portals, RDF, URIs, SPARQL etc., visit the open data portals and experiment with existing datasets, and re-use the chosen datasets in order to collect interesting data and develop interesting visualizations that show the data’s potential added value.

3.1.3.2 Generate learning activities

A number of activities were designed within the e-learning platform in order to support the execution of the PBL learning model.

The activities generated were:

- Lecturing: we provided information on the content in order to activate students’ interest and set the main knowledge basis for the work to be carried out (Activation).

- Research on existing datasets: we provided a list of open data portals so that students can navigate and research existing datasets from multiple sectors (Activation, Self-driven learning).

- Analysis of the datasets’ elements into individual concepts: students were required to study chosen datasets and distinguish the different elements that comprise the dataset (e.g. for hotels in Thessaloniki elements include name of hotel, location, number of stars, average price etc.). (Self-driven learning, Activation, Reflection, Integration, Feedback).

- Re-use of RDF data: students were required to create 3 interesting SPARQL queries from the RDF data they chose. Each query had to provide meaningful information and had to have a scalable complexity (Activation, Demonstration, Application).

- Create visualisations using open data: students were required to create at least one interesting visualization that generates added value from the open data, using specialized software (e.g. MS Excel, Tableau or Sgvizler) (Demonstration, Application, Integration).
• Create blog post or wiki: students were required to write a short post within a blog or a wiki, describing their work and their visualization and highlighting the added value and benefits of machine readable open data (Integration, Demonstration, Reflection, Critical thinking, Feedback).

• Present findings: students were required to create a presentation of their work and findings (Reflection, Feedback, Integration).

• Reflect on theory comprehension and course: students were required to answer quizzes with questions about each unit of learning, as well as assess the course’s efficiency (Feedback, Reflection).

3.1.3.3 Define assessment
The final design step regards the definition of the assessment of students’ performance. The decisions made for this step included:

• Type of assessment. Taking into consideration the PBL strategy’s principles, the course included a combination of formative and summative evaluation. Each group was assessed weekly on their project progress, in order to avoid any misconceptions and prevent at-risk failures. Additionally, a final exam with questions and exercises on the taught material will be employed at the end of the academic semester. The group assignment comprises the 50% of the final grade and the exam the other 50%.

• Target of assessment. Students would be evaluated on a group and on an individual level. We will monitor the group’s progress during the project’s execution, as well as each student’s contribution within the group from the LA tools within Moodle. Additionally, we will evaluate each individual performance based on the student’s participation in the e-learning platform and on their final exam.

• Timing and location of assessment. The group assessment will be carried out across the entire academic semester, where we will monitor each group interaction with the e-learning platform. The individual assessment will be carried out within the e-learning platform as well as offline during the final examination.
Mechanisms of assessment. A number of LA tools, as documented in Table 3 will be employed for the students’ evaluation within the e-learning platform. Evaluation criteria will include students’ sessions in the platform, posts on forums and wikis, answers in quizzes and feedback questionnaires, assignments submissions, learning resources access etc. An offline assessment mechanism will include the final exam, with questions and exercises that will cover the taught learning content on open and linked data.

3.1.3.4 Check the design

The verification of our design decisions was carried out by examining whether the activities designed and the ICT (PBL and LA) tools included within the e-learning platform could support the development of the identified competencies and comprehension of the taught learning content. We made sure that students will be able to access and navigate through real world open data in order to investigate real workplace and societal problems.

Students will also be able to utilize open data tools and experiment with re-using open data towards meaningful visualisations so that they can gain the skills identified in the learning objectives and outcomes. The usage of collaborative tools such as wiki will help students develop critical thinking and collaborative skills while their contribution through quizzes and feedback questionnaires will increase their reflection skills.

3.2 Trial delivery for BSc “e-Government” course

3.2.1 Delivery method and course structure

The course was delivered using a blended method; students were required to use the Moodle e-learning platform in order to access the learning content, upload their assignments and interact with the PBL tools during the project phase. Students also were required to study the taught learning content at home and prepare the different tasks of the group project using non e-learning tools (e.g. online open data portals, OpenRefine, RDF store, SPARQL endpoint, Tableau etc.).

We followed the recommended course duration of the University course model proposed in D3.1 with 13 weeks of lectures.
The learning content was available to the students in the e-learning platform; each week we uploaded the subject that would be taught in the form of PDF files. More specifically, the content provided was:

**Week 1: Course context, introduction to e-government (slides in Greek, link to 5 star open data model information)**

The main purpose of this week was to introduce students to the course, present learning objectives, curriculum structure and outcomes, and introduce them to the field of e-government.

This week’s learning outcomes were:

- Knowledge] Define e-government
- Knowledge] Define Open Government Data

**Week 2: e-government policies (slides in Greek, links to resources on e-government strategies)**

The main purpose of this week was to introduce students to the e-government policies, challenges and benefits.

This week’s learning outcomes were:

- Knowledge] Define e-government policies
- Knowledge] List e-government challenges
- Knowledge] List e-government benefits
- Knowledge] List Greek and European strategies and priorities for e-government

**Week 3: e-participation (slides in Greek, links to e-participation cases)**

The main purpose of this week was to introduce students to the e-participation field.

This week’s learning outcomes were:

- Knowledge] Define e-participation
- Knowledge] List e-participation areas and lifecycle
- Knowledge] List technologies for e-participation and policy making
- Skill] Use e-participation technologies

**Week 4: Open Data (slides in Greek, link to Open Data UOM portal)**
The main purpose of this week was to introduce students to Open Data.

This week’s learning outcomes were:

[Knowledge] Define Open Data

[Knowledge] Define high quality Open Data

[Knowledge] Understand storytelling through Open Data

[Knowledge] Define and understand the concept of Linked Data

Week 5: Open Data culture (slides in Greek, links to Open Data portals, links to additional resources)

The links provided were:

- European Open Data learning portal
- Coursera free MOOC: Data-driven Decision Making by PwC
- ODI training-1, ODI training-2
- Wikipedia-open data
- Open knowledge Foundation
- open data Handbook
- Data Journalism Handbook
- Tim Berners-Lee 5-star deployment scheme

The main purpose of this week was to introduce students to Open Data culture.

This week’s learning outcomes were:

[Knowledge] Define what makes Open Data open

[Knowledge] List examples of Open Data

[Knowledge] Explain how Open Data can create value

[Knowledge] Recall success stories and startups that were based on Open Data

[Knowledge] Understand open standards

Week 6: Open Data academic practice (slides in Greek, links of Open Data business cases)

The links provided were:

- https://tfl.gov.uk/
- https://www.mysociety.org/about/
- https://kimittud.atlatszo.hu/
The main purpose of this week was to help students assess critically the usage of good practices in Open Data in regards to academic research and innovation. Students should also be able to define a research and/or innovative problem that can be resolved with the use of Open Data.

This week’s learning outcomes were:

[Knowledge] Understand why we need licenses

[Knowledge] List Open Data formats

[Knowledge] Understand metadata and Open Data annotation

[Knowledge] Understand why and when we open specific data

[Knowledge] Understand opening new businesses by exploiting Open Data

[Knowledge] List specific examples of businesses that use Open Data and gain profit

[Knowledge] List challenges that could hinder the creation of a successful Open Data business

Weeks 7 and 8: Introduction to RDF (slides in Greek, book on Linked Data, book chapter on URIs, book chapter on RDF, book chapter on RDF vocabularies)

The main purpose of this week was to introduce students to the RDF standard for describing resources semantically.

This week’s learning outcomes were:

[Knowledge] Recall the basic components of the RDF standard

[Skill] Create RDF graphs

[Knowledge] Understand the usage of RDF vocabularies for describing resources

[Knowledge] Understand the structure and purpose of a URI

[Skill] Use RDF vocabularies to describe a resource
[**Knowledge**] Understand how to structure RDF triples with Turtle

**Skill** Create RDF triples using Turtle

### Week 9: SPARQL (slides in Greek, book chapter on SPARQL, links to SPARQL tutorials)

The links provided were:

- [https://www.w3.org/TR/sparql11-overview/](https://www.w3.org/TR/sparql11-overview/)
- [https://www.w3.org/2009/Talks/0615-qbe/](https://www.w3.org/2009/Talks/0615-qbe/)

The main purpose of this week was to introduce students to SPARQL and allow them to create simple queries to retrieve data.

This week’s learning outcomes were:

- **Knowledge** Understand SPARQL structure and elements
- **Knowledge** Recall the three different ways we structure query triples in SPARQL
- **Skill** Create simple SPARQL queries based on a known RDF model

### Week 10: SPARQL (slides in Greek)

The main purpose of this week was to help students create more complex SPARQL queries.

This week’s learning outcomes were:

- **Skill** Create SPARQL queries when the RDF graph is known
- **Skill** Create SPARQL queries when the data is known
- **Skill** Create SPARQL queries when the data is not known

### Week 11: API (slides in Greek)

The main purpose of this week was to introduce students to the REST API architecture and help them use API to retrieve data.

This week’s learning outcomes were:

- **Knowledge** Recall the basic concepts of JSON and XML
- **Knowledge** Define API
- **Skill** Design based on the REST API architecture
- **Knowledge** Understand how to call APIs
[Skill] Call APIs through Chrome using Postman

[Skill] Create queries to use the APIs of the national transparency website

[Skill] Exploit data retrieved with APIs

Week 12: Public services (slides in Greek)

The main purpose of this week was to introduce students to public services, their benefits and how open government data can be used within public services.

This week’s learning outcomes were:

[Knowledge] Recall the role and importance of public services in e-government

[Knowledge] List the 20 basic public services according to EU

[Knowledge] Describe some basic public services of Greece

[Knowledge] List the two phases of public services

[Knowledge / Skill] Describe and use the EU’s CPSV model for public services

[Knowledge/Skill] Describe and use the EU’s Linked Open Data model for public services

Week 13: One Stop Gov (slides in Greek)

The main purpose of this week was to introduce students to the One Stop Gov principle.

This week’s learning outcomes were:

[Knowledge] Define One Stop Gov

[Knowledge] Describe the basic characteristics of One Stop Gov

[Skill] Analyse a One Stop Gov website into its features

[Skill] Categorise the contents of a One Stop Gov website

3.2.2 The platform

The course was structured within the Moodle e-learning platform so that students will have complete and ongoing access to all learning content, will be able to interact with their group members and submit their interim reports. The course’s structure is shown in Figure 5.
All activities that were designed in the design phase were supported with the inclusion of tools that underpin PBL principles. For example, Figure 6 shows tools that were included, such as Wiki and Forum for collaboration, Folder for content access and self-directed learning, Assignment for demonstration and application and Questionnaire for Reflection.

The majority of elements within the course comprises of content in the form of PDF files and links to external additional resources. Figure 7 shows the different learning materials as uploaded in the platform.
A variety of LA tools were also employed in order to provide us with ongoing overview of students’ actions and support us being aware of any possible misconceptions or problems in understanding the taught content. More specifically, the course was supported with the LA tools shown in Table 7.

### Table 7 LA tools for “e-Government” course

<table>
<thead>
<tr>
<th>LA tool</th>
<th>Insights/ visualizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISMO</td>
<td>Resources access, forum posts</td>
</tr>
<tr>
<td>Course dedication</td>
<td>Sessions, time spent online per student</td>
</tr>
<tr>
<td>Statistics</td>
<td>Log-in sessions</td>
</tr>
<tr>
<td>Heatmap</td>
<td>Frequency of access to an activity / material</td>
</tr>
<tr>
<td>Analytic graphs : content access</td>
<td>Graphs on access frequency / Ability to send email as warning</td>
</tr>
<tr>
<td>Analytic graphs: active students</td>
<td>Graph on students’ online sessions</td>
</tr>
<tr>
<td>Analytic graphs: submissions</td>
<td>Graphs on assignments submissions (on-time, delayed, no submissions) / Ability to send email as warning</td>
</tr>
</tbody>
</table>
A more detailed description of the LA tools will be provided in D5.1.

The PBL learning model and Open Data content led to students’ active participation within the course and their hands-on experimentation with existing Open Data. As is shown in the following Figures, students were able to investigate different data sources and produce visualisations that can help us make sense of the large amounts of primary data and create significant value. For example, Figure 8 shows a graph with the percentages of unemployment across different European countries. Information that we might have difficulty deciphering through a raw dataset shows visually that Greece, Croatia and Spain are the 3 countries with the highest unemployment ratings.

![Figure 8 Visualisation with Open Data – Unemployment in European countries](image)

Figure 9 shows interesting information from the history field, indicating for example that the Siege of Valencia in 1812 was the war with the heaviest human loss.
Figure 9 Visualisation with Open Data – Wars with heaviest human loss
4 UOM trial “Advanced Information Systems” BSc course

The following sub-sections include details on how the “Advanced Information Systems” BSc course at UOM was re-designed and delivered based on the project’s results, i.e. the PBL learning model, OD_PBL design pathway and the University course model.

The “Advanced Information Systems” course is an elective course and is taught at the 7th semester of the university’s curriculum. The course’s main subject fields included understanding the usage and the importance of advanced information systems in solving business problems and using new opportunities to create a competitive advantage.

The course was taught in a traditional setting, i.e. we presented the lecture within the classroom and students were assessed during a final exam. During the previous two years, the topic of Open Data has been slowly incorporated within the course’s curriculum in order to introduce students to this newly emerging subject. The focus of the new subject was in open data as a new field, finding and obtaining Open Data, visualising Open Data and making decisions based on Open Data. This led to the gradual transformation of the course to a more interactive setting, where students started participating actively within the classroom and using tools to exploit existing data.

The re-design of the course with the incorporation of the ODEdu learning content led to the specification of the following learning objectives:

- Understanding the usage and the importance of advanced information systems in solving business problems
- Obtaining Open Data and making interesting visualisations
- Analysing data in a way that shows their added value.

4.1 Trial 2 design

In the following sub-sections details are provided on the decisions made during the design of the e-government course, to ensure alignment with the project’s pedagogical results (i.e. PBL model, OD_PBL design pathway).

4.1.1 Understanding

The initial phase of the course re-design regarded the understanding of the course’s main elements.

4.1.1.1 Time

The course is taught one day a week for the 13 weeks of the academic semester. Each week, the course lasts 3 hours. A total of 39 hours were dedicated to delivering the course.
4.1.1.2 Context

The trial was carried out in the context of the “Advanced Information Systems” course taught at the Applied Informatics department of the University of Macedonia. The course is part of the 7th semester’s curriculum and regards topics such as information systems and Open Data.

During the trial, 9 students participated and formed two groups.

4.1.1.3 Content

The course’s content focused on Open data introduction and analysis, re-using ODEdu material from the categories of the project’s curriculum such as:

- Culture
- Academic practice
- Obtaining data
- Presenting data
- Analysing data.

More specifically, Table 8 shows the specific units of learning that were included from each curriculum category. These units of learning included content from the learning material created by ODI and from previous learning material created by UOM in the previous academic semesters.

Table 8 units of learning for “Advanced Information Systems” course

<table>
<thead>
<tr>
<th>Culture</th>
<th>Value of open data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Creating innovation with data</td>
</tr>
<tr>
<td></td>
<td>Open standards</td>
</tr>
<tr>
<td>Academic practice</td>
<td>Metadata and annotation</td>
</tr>
<tr>
<td></td>
<td>Legal issues, licensing, ethics</td>
</tr>
<tr>
<td></td>
<td>Data formats</td>
</tr>
<tr>
<td></td>
<td>Research data and innovation</td>
</tr>
<tr>
<td></td>
<td>Opening new business with open data</td>
</tr>
<tr>
<td>Obtaining data</td>
<td>Data portals</td>
</tr>
<tr>
<td></td>
<td>Search datasets in data portals</td>
</tr>
<tr>
<td></td>
<td>Select and investigate data</td>
</tr>
<tr>
<td></td>
<td>Use tools for data retrieval</td>
</tr>
<tr>
<td>Presenting data</td>
<td>Tools for presenting data</td>
</tr>
</tbody>
</table>
Identify competencies

We consulted the D1.1 report in order to identify all the different competencies that the students would be able to gain with the participation in the course. Thus, we recorded all the different outcomes (skills and knowledge) that were relevant to the course based on the materials taught and the learning objectives. This documentation is shown in Table 9.

**Table 9 Competencies identification for “e-Government” course**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>EQF level</th>
<th>Skill / Knowledge (S/K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What open data is</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>State what makes open data open</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Explain the general process, lifecycle and potential of open data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Identify key impacts and benefits of opening up data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Name the economic benefits</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Describe where we expect Open Data to be of value</td>
<td>2</td>
<td>K</td>
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<td>K</td>
</tr>
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<td></td>
<td></td>
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<td>K</td>
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<td>Identify different data formats</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>List existing Open Data portals</td>
<td>2</td>
<td>K</td>
</tr>
</tbody>
</table>
4.1.2 Alignment with pedagogical principles

After the specification of the context of the course and the identification of all the knowledge and skills that are relevant to the course, we proceeded to align our trial with the PBL pedagogical principles (meta and pragmatic). To this end, we mapped all the different PBL and LA tools that were chosen for use in our trial to each PBL principle that the tool supports. This mapping is shown in Table 10.

Table 10 Mapping of PBL principles with ICT tools

<table>
<thead>
<tr>
<th>PBL principle</th>
<th>PBL ICT tool</th>
<th>LA ICT tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem centered (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>Statistics</td>
</tr>
<tr>
<td>Collaborative learning (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Checklist</td>
<td>Statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Progress bar</td>
</tr>
<tr>
<td>Critical thinking (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Quiz</td>
<td>Statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quiz statistics</td>
</tr>
<tr>
<td>Self-driven learning and reflection (meta)</td>
<td>Student folder</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td>------------------------------------------</td>
<td>----------------</td>
<td>-----------------</td>
</tr>
<tr>
<td>Wiki</td>
<td>Learning content (Files)</td>
<td>GISMO</td>
</tr>
<tr>
<td>Quiz</td>
<td>Quiz</td>
<td>Heatmap</td>
</tr>
<tr>
<td>Checklist</td>
<td>Checklist</td>
<td>Course dedication</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Activation (pragmatic)</th>
<th>Forum</th>
<th>Analytics graphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Learning content (Files)</td>
<td></td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heatmap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Course dedication</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Demonstration (pragmatic)</th>
<th>Quiz</th>
<th>Analytics graphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feedback</td>
<td></td>
<td>GISMO</td>
</tr>
<tr>
<td>Assignment</td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quiz statistics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application (pragmatic)</th>
<th>Feedback</th>
<th>Analytics graphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assignment</td>
<td></td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Integration (pragmatic)</th>
<th>Wiki</th>
<th>Analytics graphs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>GISMO</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Feedback (pragmatic)</th>
<th>Feedback</th>
<th>Analytics graphs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quiz</td>
<td></td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quiz statistics</td>
</tr>
</tbody>
</table>

The above tools helped students execute all PBL steps within the e-learning platform, and helped teachers of UOM make sense of the students’ progress, their misconceptions and identify time for intervention.
4.1.3 Design
The design step is divided in four steps, namely: define the problem, generate learning activities, define assessment and check the design.

4.1.3.1 Define the problem
The course included one main group assignment, where each group was required to formulate, design, analyse, implement and assess a problem that can be solved by showing open data’s added value. This problem was defined as a project that combines problem solving and content teaching. Students were required to study the learning material on open data, visit the open data portals, find and retrieve suitable open datasets and analyse the chosen datasets in order to collect interesting information and develop visualizations that show the data’s potential added value.

4.1.3.2 Generate learning activities
A number of activities were designed within the e-learning platform in order to support the execution of the PBL learning model.

The activities generated were:

- Lecturing: we provided information on the content in order to activate students’ interest and set the main knowledge basis for the work to be carried out (Activation).

- Research on existing datasets: we provided a list of open data portals so that students can navigate and research existing datasets from multiple sectors (Activation, Self-driven learning).

- Analysis of the datasets’ elements into individual concepts: students were required to study chosen datasets and distinguish the different elements that comprise the dataset (e.g. for hotels in Thessaloniki elements include name of hotel, location, number of stars, average price etc.). (Self-driven learning, Activation, Reflection, Integration, Feedback).

- Create visualisations using open data: students were required to create at least one interesting visualization that generates added value from the open data, using specialized software (e.g. MS Excel, Tableau) (Demonstration, Application, Integration).
● Present findings: students were required to create a presentation of their work and findings (Reflection, Feedback, Integration).

● Reflect on theory comprehension and course: students were required to answer quizzes with questions about each unit of learning, as well as assess the course’s efficiency (Feedback, Reflection).

### 4.1.3.3 Define assessment

The final design step regards the definition of the assessment of students’ performance. The decisions made for this step included:

● **Type of assessment.** Each group was assessed weekly on their project progress, in order to avoid any misconceptions and prevent at-risk failures. Additionally, a final exam with questions and exercises on the taught material will be employed at the end of the academic semester. The group assignment comprises the 50% of the final grade and the exam the other 50%.

● **Target of assessment.** Students would be evaluated on a group and on an individual level. We will monitor the group’s progress during the project’s execution, as well as each student’s contribution within the group from the LA tools within Moodle. Additionally, we will evaluate each individual performance based on the student’s participation.

● **Timing and location of assessment.** The group assessment will be carried out across the entire academic semester, where we will monitor each group interaction in the e-learning platform. The individual assessment will be carried out within the e-learning platform as well as offline during the final examination.

● **Mechanisms of assessment.** A number of LA tools will be employed for the students’ evaluation within the e-learning platform. Evaluation criteria will include students’ sessions in the platform, posts on forums and wikis, answers in quizzes and feedback questionnaires, assignments submissions, learning resources access etc. An offline assessment mechanism will include the final exam, with questions and exercises that will cover the taught learning content on open and linked data.
4.1 University pilots report

4.1.3.4 Check the design

The verification of our design decisions was carried out by examining whether the activities designed and the ICT (PBL and LA) tools included within the e-learning platform could support the development of the identified competencies and comprehension of the taught learning content. We made sure that students will be able to access and navigate through existing open data in order to investigate real workplace and societal problems.

The usage of collaborative tools such as wiki will help students develop critical thinking and collaborative skills while their contribution through quizzes and feedback questionnaires will increase their reflection skills.

4.2 Trial delivery for BSc “Advanced Information Systems” course

4.2.1 Delivery method and course structure

The course was delivered using a blended method; students were required to use the Moodle e-learning platform in order to access the learning content, upload their assignments and interact with the PBL tools during the project phase. Students also were required to study the taught learning content at home and prepare the different tasks of the group project using non e-learning tools (e.g. online open data portals, Tableau etc.).

We followed the recommended course duration of the University course model proposed in D3.1 with 13 weeks of lectures.

The learning content was available to the students in the e-learning platform; each week we uploaded the subject that would be taught in the form of PDF files. More specifically, the content provided was:

Week 1: Course context, introduction to Open Data (slides in Greek)

The main purpose of this week was to introduce students to the course, present learning objectives, curriculum structure and outcomes, and introduce them to the field of open data.

This week’s learning outcomes were:

[Knowledge] Define data
[Knowledge] Understand the difference between open and closed data
[Knowledge] Understand the difference between structured and non-structured data
Week 2: Open Data culture (slides in Greek, links to Open Data portals, links to additional resources)

The links provided were:

- European Open Data learning portal
- Coursera free MOOC: Data-driven Decision Making by PwC
- ODI training-1, ODI training-2
- Wikipedia-open data
- Open knowledge Foundation
- open data Handbook
- Data Journalism Handbook
- Tim Berners-Lee 5-star deployment scheme

The main purpose of this week was to introduce students to Open Data culture.

This week’s learning outcomes were:

[Knowledge] Define what makes Open Data open

[Knowledge] List examples of Open Data

[Knowledge] Explain how Open Data can create value

[Knowledge] Recall success stories and startups that were based on Open Data

[Knowledge] Understand open standards

Week 3: Open Data academic practice (slides in Greek, links of Open Data business cases)

The links provided were:

- https://tfl.gov.uk/
- https://www.mysociety.org/about/
- https://kimittud.atlatszo.hu/
- http://www.fiksgatami.no/
- https://www.opentable.com/start/home
- http://www.stationmasterapp.com/features.html#accessibility
- https://opencorporates.com/
- https://product.vainu.io/
- https://www.transportapi.com/
- https://www.zoopla.co.uk/
The main purpose of this week was to help students assess critically the usage of good practices in Open Data in regards to academic research and innovation.

This week’s learning outcomes were:

- **Knowledge** Understand why we need licenses
- **Knowledge** List Open Data formats
- **Knowledge** Understand metadata and Open Data annotation
- **Knowledge** Understand why and when we open specific data
- **Knowledge** Understand opening new businesses by exploiting Open Data
- **Knowledge** List specific examples of businesses that use Open Data and gain profit
- **Knowledge** List challenges that could hinder the creation of a successful Open Data business

**Week 4: Open Data for innovation and research (slides in Greek)**

The main purpose of this week was to help students define a research and/or innovative problem that can be resolved with the use of Open Data.

This week’s learning outcomes were:

- **Knowledge** List different types of applications that can be created with Open Data
- **Knowledge** List different domains that could exploit Open Data
- **Knowledge** Discover preferences of consumers through Open Data so that companies can improve products/services
- **Knowledge** Acknowledge how Open Data can support growth by discovering new opportunities for innovation

**Week 5: Obtaining data (slides in Greek)**

The main purpose of this week was to help students locate the correct type of data and datasets in order to solve given problems.

This week’s learning outcomes were:

- **Knowledge** List sources that contain Open Data
- **Skill** Search datasets in an Open Data portal
- **Skill** Navigate within a dataset
[Skill] Understand which dataset portals are reliable

[Skill] Identify and assess dataset portals

[Skill] Download datasets

[Knowledge] Use tools that help process and link different datasets

Week 6: Presenting data (slides in Greek, PDF file for Tableau)

The main purpose of this week was to help students visualise and present basic and interesting findings from Open Data analysis.

This week’s learning outcomes were:

[Knowledge/Skill] Connect a story to visualised Open Data

[Knowledge] Identify tools for Open Data presentation and storytelling

[Knowledge] Identify tools for Open Data visualisation

[Skill] Use tools for Open Data presentation and visualisation

Week 7: Analysing data (slides in Greek, PDF file for Rapidminer, more files for Tableau)

The main purpose of this week was to help students list and describe the basic characteristics of a data warehouse and understand how predictive and text analytics can support decision making.

This week’s learning outcomes were:

[Knowledge] Define a data warehouse

[Knowledge] Define data analytics

[Knowledge] Understand the 8 basic types of data mining technologies

[Knowledge] Understand decision support systems

[Knowledge] Understand data mining and data analytics

Week 9: Advanced Open Data (slides in Greek)

The main purpose of this week was to introduce students to various Open Data topics that can support a business and produce added value.

This week’s learning outcomes were:

[Knowledge] Define cloud computing
Week 10: Design presentations

The main purpose of this week was to allow students to present their designs to the class and receive constructive feedback in order to correct any mistakes or clarify any misconceptions.

Week 11: Implementation presentations

The main purpose of this week was to allow students to present their implementations to the class and receive constructive feedback.

Week 12: Evaluation presentations

The main purpose of this week was to allow students to present the evaluation of their work to the class and receive constructive feedback.

Week 13: Conclusions and remarks

The main purpose of this week was to allow students to ask any questions on the taught material and receive a brief summary of the taught subject field before the final examination. During this week students also sent their final report, and were able to discuss and reflect on the work done in this course.

4.2.2 The platform

The course was structured within the Moodle e-learning platform so that students will have complete and ongoing access to all learning content, will be able to interact with their group members and submit their interim reports. The course’s structure is shown in Figure 10.
All activities that were designed in the design phase were supported with the inclusion of tools that underpin PBL principles. For example, Figure 11 shows tools that were included, such as Wiki and Forum for collaboration, Folder and Student folder for content access and self-directed learning, Assignment for demonstration and application, Quiz and Questionnaire for Reflection and Tasks allocation for collaboration and critical thinking.

Figure 10 "Advanced Information Systems" course structure in Moodle
Figure 11 Moodle tools for PBL support

The majority of elements within the course comprises of content in the form of PDF files.

A variety of LA tools were also employed in order to provide us with ongoing overview of students’ actions and support us being aware of any possible misconceptions or problems in understanding the taught content. More specifically, the course was supported with the LA tools shown in Table 11.

Table 11 LA tools for “Advanced Information Systems” course

<table>
<thead>
<tr>
<th>LA tool</th>
<th>Insights/ visualizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISMO</td>
<td>Resources access, forum posts, quiz grades</td>
</tr>
</tbody>
</table>
A more detailed description of the LA tools will be provided in D5.1.

The PBL learning model and Open Data content led to students’ active participation within the course and their hands-on experimentation with existing Open Data. As is shown in the following Figures, students were able to investigate different data sources and produce visualisations that can help us make sense of the large amounts of primary data and create significant value. For example, Figure 13 shows a map with the frequency of children’s mortalities across the world during the 1990s, while Figure 14 shows the main reasons of car accidents in Greece for the years 2014, 2015 and 2016. Information that we might have difficulty deciphering through a raw dataset shows visually that the main types of vehicles involved in car accidents include private vehicles and motorcycles for all three years.
Παιδική θνησιμότητα το δεύτερο μισό του 1990 ανα τον κόσμο

Figure 13 Child mortality worldwide during the second half of the 1990s

Figure 14 Car accidents in Greece for 2014 – 2016
5 UOM trial “Innovative Systems for e-Business” MSc course

The following sub-sections include details on how the “Innovative Systems for e-Business” MSc course at UOM was re-designed and delivered based on the project’s results, i.e. the PBL learning model, OD_PBL design pathway and the University course model.

The “Innovative Systems for e-Business” course is an elective course and is taught at the 2nd semester of the postgraduate program of the Applied Informatics department. The course’s main subject fields included understanding the usage and the importance of advanced information systems in solving business problems and using new opportunities to create a competitive advantage.

The course was taught in a traditional setting, i.e. we presented the lecture within the classroom and students were assessed during a final exam. During the previous two years, the topic of Open Data has been slowly incorporated within the course’s curriculum in order to introduce students to this newly emerging subject. The focus of the new subject was in open data as a new field, finding and obtaining Open Data, visualising Open Data and making decisions based on Open Data. This led to the gradual transformation of the course to a more interactive setting, where students started participating actively within the classroom and using tools to exploit existing data.

The re-design of the course with the incorporation of the ODEdu learning content led to the specification of the following learning objectives:

- Visualising and analysing Open Data for supporting business decisions
- Creating applications of added value based on Open Data
- Tell stories based on Open Data.

5.1 Trial 3 design

In the following sub-sections details are provided on the decisions made during the design of the e-government course, to ensure alignment with the project’s pedagogical results (i.e. PBL model, OD_PBL design pathway).

5.1.1 Understanding

The initial phase of the course re-design regarded the understanding of the course’s main elements.

5.1.1.1 Time

The course is taught one day a week for the 12 weeks of the academic semester. Each week, the course lasts 3 hours. A total of 36 hours were dedicated to delivering the course.
5.1.1.2 Context

The trial was carried out in the context of the “Innovative Systems for e-Business” course taught at the postgraduate programme of the Applied Informatics department of the University of Macedonia. The course is part of the 2nd semester’s curriculum and regards topics such as information systems and Open Data.

During the trial, 5 students participated and formed one group.

5.1.1.3 Content

The course’s content focused on Open data introduction and analysis, re-using ODEdu material from the categories of the project’s curriculum such as:

- Culture
- Academic practice
- Obtaining data
- Presenting data
- Analysing data
- Advanced technical skills.

More specifically, Table 12 shows the specific units of learning that were included from each curriculum category. These units of learning included content from the learning material created by ODI and from previous learning material created by UOM in the previous academic semesters.

Table 12 units of learning for “Innovative Systems for e-Business” course

<table>
<thead>
<tr>
<th>Culture</th>
<th>Value of open data</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Creating innovation with data</td>
</tr>
<tr>
<td></td>
<td>Open standards</td>
</tr>
<tr>
<td>Academic practice</td>
<td>Metadata and annotation</td>
</tr>
<tr>
<td></td>
<td>Legal issues, licensing, ethics</td>
</tr>
<tr>
<td></td>
<td>Data formats</td>
</tr>
<tr>
<td></td>
<td>Research data and innovation</td>
</tr>
<tr>
<td></td>
<td>Opening new business with open data</td>
</tr>
<tr>
<td>Obtaining data</td>
<td>Data portals</td>
</tr>
<tr>
<td></td>
<td>Search datasets in data portals</td>
</tr>
<tr>
<td></td>
<td>Select and investigate data</td>
</tr>
<tr>
<td></td>
<td>Use tools for data retrieval</td>
</tr>
</tbody>
</table>
Identify competencies

We consulted the D1.1 report in order to identify all the different competencies that the students would be able to gain with the participation in the course. Thus, we recorded all the different outcomes (skills and knowledge) that were relevant to the course based on the materials taught and the learning objectives. This documentation is shown in Table 13.

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</tr>
<tr>
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<tr>
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<td>K</td>
</tr>
<tr>
<td>Identify ways to engage with journalists and other relevant public</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>domain actors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Task</td>
<td>Level</td>
<td>Type</td>
</tr>
<tr>
<td>---------------------------------------------------------------------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
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<td>2</td>
<td>K</td>
</tr>
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<td>How to annotate my data so that they are correctly understood</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>More about data formats</td>
<td>3</td>
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</tr>
<tr>
<td>Identify different data formats</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>List existing Open Data portals</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Search an Open Data portal</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>Identify how Open Data is supporting growth by revealing opportunities for businesses</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>Identify the OD tools for presenting</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>List different characteristics of a warehouse</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Describe the 8 main types of data mining tools</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Search and select open data from online portals</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>Identify interesting data from open data portals</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>Use data analysis and visualizations tools</td>
<td>6</td>
<td>S</td>
</tr>
<tr>
<td>Perform data modelling</td>
<td>6</td>
<td>S</td>
</tr>
<tr>
<td>Create data structures</td>
<td>6</td>
<td>S</td>
</tr>
<tr>
<td>Explain what Linked Data is</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Differentiate between linked data and data on the Web in general</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>Retrieve linked data e.g. using SPARQL</td>
<td>7</td>
<td>S</td>
</tr>
<tr>
<td>Explain what SPARQL is and how it's different from SQL</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>Recall examples with SPARQL</td>
<td>7</td>
<td>S</td>
</tr>
<tr>
<td>Create triples and RDF graphs</td>
<td>7</td>
<td>S</td>
</tr>
<tr>
<td>Create RDF</td>
<td>7</td>
<td>S</td>
</tr>
</tbody>
</table>

### 5.1.2 Alignment with pedagogical principles

After the specification of the context of the course and the identification of all the knowledge and skills that are relevant to the course, we proceeded to align our trial with the PBL pedagogical principles (meta and pragmatic). To this end, we mapped all the different PBL and LA tools that were
chosen for use in our trial to each PBL principle that the tool supports. This mapping is shown in Table 14.

Table 14 Mapping of PBL principles with ICT tools

<table>
<thead>
<tr>
<th>PBL principle</th>
<th>PBL ICT tool</th>
<th>LA ICT tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem centered (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>Statistics</td>
</tr>
<tr>
<td>Collaborative learning (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Checklist</td>
<td>Statistics</td>
</tr>
<tr>
<td>Critical thinking (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td>Self-driven learning and reflection (meta)</td>
<td>Student folder</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Wiki</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Learning content (Files)</td>
<td>Heatmap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Course dedication</td>
</tr>
<tr>
<td>Activation (pragmatic)</td>
<td>Forum</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Learning content (Files)</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Heatmap</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Course dedication</td>
</tr>
<tr>
<td>Demonstration (pragmatic)</td>
<td>Feedback</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td>Application (pragmatic)</td>
<td>Feedback</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
</tbody>
</table>
The above tools helped students execute all PBL steps within the e-learning platform, and helped teachers of UOM make sense of the students’ progress, their misconceptions and identify time for intervention.

5.1.3 Design

The design step is divided in four steps, namely: define the problem, generate learning activities, define assessment and check the design.

5.1.3.1 Define the problem

The course included one main group assignment, where the group was required to choose one of two cases:

1. Develop an application by obtaining, visualising and analysing data
2. Create three storytelling cases based on Open Data

5.1.3.2 Generate learning activities

A number of activities were designed within the e-learning platform in order to support the execution of the PBL learning model.

The activities generated were:

- Lecturing: we provided information on the content in order to activate students’ interest and set the main knowledge basis for the work to be carried out (Activation).
- Research on existing datasets: we provided a list of open data portals so that students can navigate and research existing datasets from multiple sectors (Activation, Self-driven learning).
Analysis of the datasets’ elements into individual concepts: students were required to study chosen datasets and distinguish the different elements that comprise the dataset (e.g. for hotels in Thessaloniki elements include name of hotel, location, number of stars, average price etc.). (Self-driven learning, Activation, Reflection, Integration, Feedback).

Re-use of RDF data: students were required to create interesting SPARQL queries from the RDF data they chose. Each query had to provide meaningful information and had to have a scalable complexity (Activation, Demonstration, Application).

Create visualisations using open data: students were required to create at least one interesting visualization that generates added value from the open data, using specialized software (e.g. MS Excel, Tableau or Sgvizler) (Demonstration, Application, Integration).

Present findings: students were required to create a presentation of their work and findings (Reflection, Feedback, Integration).

Reflect on theory comprehension and course: students were required to answer quizzes with questions about each unit of learning, as well as assess the course’s efficiency (Feedback, Reflection).

5.1.3.3 Define assessment

The final design step regards the definition of the assessment of students’ performance. The decisions made for this step included:

- Type of assessment. Each group was assessed weekly on their project progress, in order to avoid any misconceptions and prevent at-risk failures. Additionally, a final exam with questions and exercises on the taught material will be employed at the end of the academic semester. The group assignment comprises the 50% of the final grade and the exam the other 50%.

- Target of assessment. Students would be evaluated on a group and on an individual level. We will monitor the group’s progress during the project’s execution, as well as each student’s contribution within the group from the LA tools within Moodle. Additionally, we will evaluate each individual performance based on the student’s participation.
● Timing and location of assessment. The group assessment will be carried out across the entire academic semester, where we will monitor each group interaction in the e-learning platform. The individual assessment will be carried out within the e-learning platform as well as offline during the final examination.

● Mechanisms of assessment. A number of LA tools will be employed for the students’ evaluation within the e-learning platform. Evaluation criteria will include students’ sessions in the platform, posts on forums and wikis, answers in quizzes and feedback questionnaires, assignments submissions, learning resources access etc. An offline assessment mechanism will include the final exam, with questions and exercises that will cover the taught learning content on open and linked data.

5.1.3.4 Check the design
The verification of our design decisions was carried out by examining whether the activities designed and the ICT (PBL and LA) tools included within the e-learning platform could support the development of the identified competencies and comprehension of the taught learning content. We made sure that students will be able to access and navigate through existing open data in order to investigate real workplace and societal problems.

The usage of collaborative tools such as wiki will help students develop critical thinking and collaborative skills while their contribution through quizzes and feedback questionnaires will increase their reflection skills.

5.2 Trial delivery for MCs “Innovative Systems for e-Business” course

5.2.1 Delivery method and course structure
The course was delivered using a blended method; students were required to use the Moodle e-learning platform in order to access the learning content, upload their assignments and interact with the PBL tools during the project phase. Students also were required to study the taught learning content at home and prepare the different tasks of the group project using non e-learning tools (e.g. online open data portals, Tableau etc.).
We followed the recommended course duration of the University course model proposed in D3.1 with 12 weeks of lectures.

The learning content was available to the students in the e-learning platform; each week we uploaded the subject that would be taught in the form of PDF files. More specifically, the content provided was:

**Week 1: Course context, introduction to Open Data (slides in Greek)**

The main purpose of this week was to introduce students to the course, present learning objectives, curriculum structure and outcomes, and introduce them to the field of open data.

This week’s learning outcomes were:

- [Knowledge] Define data
- [Knowledge] Understand the importance of Open and Linked Data
- [Knowledge] Understand data storytelling and data apps

**Week 2: Open Data culture (slides in Greek, links to Open Data portals, links to additional resources)**

The links provided were:

- *Data Viz: Hans Rosling's 200 Countries, 200 Years, 4 Minutes - The Joy of Stats - BBC Four*
- *Creating value through Open Data*
- *5 star Open Data model*
- *European Open Data learning portal*
- *Coursera free MOOC: Data-driven Decision Making by PwC*
- *ODI training-1, ODI training-2*
- *Wikipedia-open data*
- *Open knowledge Foundation*
- *open data Handbook*
- *Data Journalism Handbook*
- *Tim Berners-Lee 5-star deployment scheme*

The main purpose of this week was to introduce students to Open Data culture.

This week’s learning outcomes were:

- [Knowledge] Define what makes Open Data open
- [Knowledge] List examples of Open Data
[Knowledge] Explain how Open Data can create value

[Knowledge] Recall success stories and startups that were based on Open Data

[Knowledge] Understand open standards

Week 3: Obtaining data (slides in Greek, links to Open Data portals, links to other resources)

Links provided included:

- http://data.dai.uom.gr/
- Registration guidelines to UOM data portal
- data.gov.uk
- africaopendata.org
- data.gov.gr
- https://data.amsterdam.nl/?mpb=topografie&mpz=11&mpv=52.3731081:4.8932945&pgn=home
- https://www.dat.i.lombardia.it/
- http://ckan.okfn.gr/

The main purpose of this week was to help students locate the correct type of data and datasets in order to solve given problems.

This week’s learning outcomes were:

[Knowledge] List sources that contain Open Data

[Skill] Search datasets in an Open Data portal

[Skill] Navigate within a dataset

[Skill] Understand which dataset portals are reliable

[Skill] Identify and assess dataset portals

[Skill] Download datasets

[Knowledge] Use tools that help process and link different datasets

Week 4: Presenting data (slides in Greek)
The main purpose of this week was to help students visualise and present basic and interesting findings from Open Data analysis.

This week’s learning outcomes were:

[Knowledge/Skill] Connect a story to visualised Open Data
[Knowledge] Identify tools for Open Data presentation and storytelling
[Knowledge] Identify tools for Open Data visualisation
[Skill] Use tools for Open Data presentation and visualisation

Week 5: Visualising data (slides in Greek, PDF file for Rapidminer, tutorial for Tableau in PDF, Excel file with unemployment data for Tableau, example usage for Tableau in PDF, Open Coursera course on "Data-driven Decision Making" by PwC)

The main purpose of this week was to help students understand the different ways to visualise data and use Open Data visualisation tools.

This week’s learning outcomes were:

[Knowledge] Link stories with Open Data
[Knowledge] Identify Open Data tools for visualising
[Skill] Use Open Data tools for visualisation

Week 6: Analysing data (slides in Greek, more files for Tableau, links with resources)

Links provided included:

- [Linked Open Data book](#)
- [Book chapter on URIs](#)
- [Book chapter on triples and RDF](#)
- [Book chapter on RDF vocabularies](#)

The main purpose of this week was to introduce students to the RDF standard for describing resources semantically.

This week’s learning outcomes were:

[Knowledge] Recall the basic components of the RDF standard
[Skill] Create RDF graphs
[Knowledge] Understand the usage of RDF vocabularies for describing resources
[Knowledge] Understand the structure and purpose of a URI

[Skill] Use RDF vocabularies to describe a resource

[Knowledge] Understand how to structure RDF triples with Turtle

[Skill] Create RDF triples using Turtle

Week 7: SPARQL (slides in Greek, book chapter on SPARQL, links to SPARQL tutorials)

The links provided were:

- https://www.w3.org/TR/sparql11-overview/
- https://www.w3.org/2009/Talks/0615-qbe/

The main purpose of this week was to introduce students to SPARQL and allow them to create simple queries to retrieve data.

This week’s learning outcomes were:

[Knowledge] Understand SPARQL structure and elements

[Knowledge] Recall the three different ways we structure query triples in SPARQL

[Skill] Create simple SPARQL queries based on a known RDF model

Week 8: SPARQL (slides in Greek)

The main purpose of this week was to help students create more complex SPARQL queries.

This week’s learning outcomes were:

[Skill] Create SPARQL queries when the RDF graph is known

[Skill] Create SPARQL queries when the data is known

[Skill] Create SPARQL queries when the data is not known

Week 9: API (slides in Greek)

The main purpose of this week was to introduce students to the REST API architecture and help them use API to retrieve data.

This week’s learning outcomes were:

[Knowledge] Recall the basic concepts of JSON and XML

[Knowledge] Define API
[Skill] Design based on the REST API architecture

[Knowledge] Understand how to call APIs

[Skill] Call APIs through Chrome using Postman

[Skill] Create queries to use the APIs of the national transparency website

[Skill] Exploit data retrieved with APIs

Week 10: Analysing data with Rapidminer (slides in Greek, Excel files with datasets for usage of Rapidminer)

The main purpose of this week was to introduce students to data analytics with Rapidminer and MS Excel.

This week’s learning outcomes were:

[Knowledge] List different types of data analysis

[Skill] Use Rapidminer to analyse data

Week 11: Linked Open Statistical Data (slides in Greek)

The main purpose of this week was to help students experiment with existing datasets and become more proficient in creating RDF cubes and SPARQL queries.

This week’s learning outcomes were:

[Knowledge] List the different elements of the cube data structure

[Skill] Navigate across the official statistical data of Scotland

[Skill] Use the RDF-qb model to structure datasets in RDF cubes.

[Skill] Create SPARQL queries at the Scottish statistical data SPARQL endpoint.

Week 12: Exploratory (slides in Greek, tutorials)

Links provided included:

- **Exploratory tutorial**

The main purpose of this week was to help students learn how to use the Exploratory tool in order to visualise and analyse Open Data.

This week’s learning outcomes were:
[Skill] Use Exploratory to import datasets

[Skill] Use Exploratory to retrieve datasets from SPARQL endpoints

[Skill] Use Exploratory to create simple and more complex SPARQL queries

[Skill] Use Exploratory to create different types of visualisations with Open Data.

5.2.2 The platform

The course was structured within the Moodle e-learning platform so that students will have complete and ongoing access to all learning content, will be able to interact with their group members and submit their interim reports. The course’s structure is shown in Figure 13.
<table>
<thead>
<tr>
<th>Category</th>
<th>Subcategory</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Management</td>
<td>Project Management Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Execution Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Evaluation Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Closure Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Documentation</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Repository</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Meeting</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Reports</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Risk Assessment Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Quality Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Tool</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Software</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Office</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Strategies</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Practices</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Policies</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Processes</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Procedures</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Tools</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Workflows</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Management Workload</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Plan</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Team</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workload</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workload</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workload</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workload</td>
<td></td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
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<tr>
<td>Project Management</td>
<td>Project Monitoring Workload</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Workload</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Tools</td>
<td></td>
</tr>
<tr>
<td>Project Management</td>
<td>Project Monitoring Workflows</td>
<td></td>
</tr>
</tbody>
</table>
All activities that were designed in the design phase were supported with the inclusion of tools that underpin PBL principles. For example, Figure 16 shows tools that were included, such as Wiki and Forum for collaboration, Folder for content access and self-directed learning, Assignment for demonstration and application and Questionnaire for Reflection.
The majority of elements within the course comprises of content in the form of PDF files.

![Image](image.png)

**Figure 17** Learning content for “Innovative Systems for e-Business” course

A variety of LA tools were also employed in order to provide us with ongoing overview of students’ actions and support us being aware of any possible misconceptions or problems in understanding the taught content. More specifically, the course was supported with the LA tools shown in Table 15.

**Table 15** LA tools for “Innovative Systems for e-Business” course

<table>
<thead>
<tr>
<th>LA tool</th>
<th>Insights/ visualizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISMO</td>
<td>Resources access, forum posts</td>
</tr>
<tr>
<td>Course dedication</td>
<td>Sessions, time spent online per student</td>
</tr>
<tr>
<td>Statistics</td>
<td>Log-in sessions</td>
</tr>
<tr>
<td>Heatmap</td>
<td>Frequency of access to an activity / material</td>
</tr>
<tr>
<td>Analytic graphs: content access</td>
<td>Graphs on access frequency / Ability to send email as warning</td>
</tr>
<tr>
<td>Analytic graphs: active</td>
<td>Graph on students’ online sessions</td>
</tr>
</tbody>
</table>
A more detailed description of the LA tools will be provided in D5.1.

The PBL learning model and Open Data content led to students’ active participation within the course and their hands-on experimentation with existing Open Data. As is shown in the following Figure, students were able to investigate different data sources and produce visualisations that can help us make sense of the large amounts of primary data and create significant value.

For example, Figure 18 shows a map that shows the location of all the lakes in Greece, a babble graph that shows the frequency of eye colour for all citizens of Europe and a dashboard that shows paintings and dates of famous French painters. Information that we might have difficulty deciphering through a raw dataset shows visually where all of Greece’s lakes are located and that the most prominent eye colour in Europe is blue.
Figure 18 Visualisations of students for “Innovative Systems for e-Business” course
6 UOM trial “Management Information Systems” BSc course

The following sub-sections include details on how the “Management Information Systems” BSc course at UOM was re-designed and delivered based on the project’s results, i.e. the PBL learning model, OD_PBL design pathway and the University course model.

The “Management Information Systems” course is a core course and is taught at the 1st semester of the Applied Informatics department. The course’s main subject fields included understanding the usage and the importance of management information systems in solving business problems and using new opportunities to create a competitive advantage.

The course was taught in a traditional setting, i.e. we presented the lecture within the classroom and students were assessed during a final exam. The re-design of the course with the incorporation of the ODEdu learning content led to the specification of the following learning objectives:

- Visualising and analysing Open Data for supporting business decisions
- Creating applications of added value based on Open Data

Due to the fact that this course was taught in the fall 2018-2019 semester and it will be completed in February 2019, i.e. after the project’s duration, the adoption of the ODEdu paradigm (curriculum, PBL model, LA assessment) was carried out in part and not throughout the entire course, as a project within the main course.

6.1 Trial 3 design

In the following sub-sections details are provided on the decisions made during the design of the e-government course, to ensure alignment with the project’s pedagogical results (i.e. PBL model, OD_PBL design pathway).

6.1.1 Understanding

The initial phase of the course re-design regarded the understanding of the course’s main elements.

6.1.1.1 Time

The course is taught one day a week for the 12 weeks of the academic semester. Each week, the course lasts 3 hours. The project that focuses on Open Data will last 3 weeks.

6.1.1.2 Context

The trial was carried out in the context of the “Management Information Systems” course taught at the Applied Informatics department of the University of Macedonia. The course is part of the 1st semester’s curriculum and focuses on management information systems.

During the trial, 238 students participated and formed 48 groups.
6.1.1.3 Content

The project’s content within the course focused on Open data introduction and analysis, re-using ODEdu material from the categories of the project’s curriculum such as:

- Obtaining data
- Presenting data

More specifically, Table 16 shows the specific units of learning that were included from each curriculum category. These units of learning included content from the learning material created by ODI and from previous learning material created by UOM in the previous academic semesters.

**Table 16 units of learning for “Management Information Systems” course**

<table>
<thead>
<tr>
<th>Obtaining data</th>
<th>Data portals</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search datasets in data portals</td>
<td></td>
</tr>
<tr>
<td>Select and investigate data</td>
<td></td>
</tr>
<tr>
<td>Use tools for data retrieval</td>
<td></td>
</tr>
<tr>
<td>Presenting data</td>
<td>Tools for presenting data</td>
</tr>
<tr>
<td>Tools for visualising data (Tableau)</td>
<td></td>
</tr>
</tbody>
</table>

**Identify competencies**

We consulted the D1.1 report in order to identify all the different competencies that the students would be able to gain with the participation in the course. Thus, we recorded all the different outcomes (skills and knowledge) that were relevant to the course based on the materials taught and the learning objectives. This documentation is shown in Table 17.

**Table 17 Competencies identification for “Management Information Systems” course**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>EQF level</th>
<th>Skill / Knowledge (S/K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>What open data is</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>State what makes open data open</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Identify key impacts and benefits of opening up data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Describe where we expect Open Data to be of value</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>Explain how OD creates value</td>
<td>2</td>
<td>K</td>
</tr>
</tbody>
</table>
List existing Open Data portals 2 K
Search an Open Data portal 3 S
Identify how Open Data is supporting growth by revealing opportunities for businesses 3 K
Identify the OD tools for presenting 2 K
Search and select open data from online portals 3 S
Identify interesting data from open data portals 3 S
Use data analysis and visualizations tools 6 S

6.1.2 Alignment with pedagogical principles

After the specification of the context of the course and the identification of all the knowledge and skills that are relevant to the course, we proceeded to align our trial with the PBL pedagogical principles (meta and pragmatic). To this end, we mapped all the different PBL and LA tools that were chosen for use in our trial to each PBL principle that the tool supports. This mapping is shown in Table 18.

Table 18 Mapping of PBL principles with ICT tools

<table>
<thead>
<tr>
<th>PBL principle</th>
<th>PBL ICT tool</th>
<th>LA ICT tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem centered (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>Assignment</td>
<td>Statistics</td>
</tr>
<tr>
<td>Collaborative learning (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Forum</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td>Critical thinking (meta)</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Statistics</td>
</tr>
<tr>
<td>Self-driven learning and reflection</td>
<td>Wiki</td>
<td>Analytics graphs</td>
</tr>
<tr>
<td>(meta)</td>
<td>Learning content</td>
<td>GISMO</td>
</tr>
<tr>
<td></td>
<td>(Files)</td>
<td>Heatmap</td>
</tr>
</tbody>
</table>
### Activation (pragmatic)
- Forum
- Learning content (Files)
- Analytics graphs
- GISMO
- Heatmap
- Course dedication

### Demonstration (pragmatic)
- Feedback
- Assignment
- Analytics graphs
- GISMO
- Statistics

### Application (pragmatic)
- Feedback
- Assignment
- Analytics graphs
- GISMO
- Statistics

### Integration (pragmatic)
- Wiki
- Analytics graphs
- GISMO

### Feedback (pragmatic)
- Feedback
- Analytics graphs
- GISMO

The above tools helped students execute all PBL steps within the e-learning platform, and helped teachers of UOM make sense of the students’ progress, their misconceptions and identify time for intervention.

#### 6.1.3 Design

The design step is divided in four steps, namely: define the problem, generate learning activities, define assessment and check the design.

#### 6.1.3.1 Define the problem

The course’s project included one main group assignment, where each group was required to follow a given scenario and perform a series of activities. Based on the scenario, each group was a part of a consulting agency that had as a client the Municipality of Thessaloniki, Greece. The Municipality is requesting innovative ideas for web-based or mobile applications. As the same time, one of Municipality’s main objectives is the remodelling of the city’s marina, where many citizens gather...
daily for walking, running or visiting the parks and outdoor playgrounds nearby. These citizens are already using data for enjoyment, information, work etc. Another strategic goal is the exploitation of open data. Thus, it is probable that the Municipality is requesting proposals of applications that will be based in open data and support the citizens that visit the marina daily. Hence, each group should propose ideas that are based on open data (provided by the Municipality or from other data providers) and present a few indicative visualizations of these data using the Tableau software.

6.1.3.2 Generate learning activities

A number of activities were designed within the e-learning platform in order to support the execution of the PBL learning model.

The activities generated were:

- Lecturing: we provided information on the content in order to activate students’ interest and set the main knowledge basis for the work to be carried out (Activation).

- Research on existing datasets: we provided a list of open data portals so that students can navigate and research existing datasets from multiple sectors (Activation, Self-driven learning).

- Document meeting minutes: each group was required to post on their group-based wiki and record all minutes from each group meeting. The minutes included information such as participants, date and time of meeting, meeting topics, meeting decisions, next actions (Collaboration, Activation, Reflection).

- Analysis of the datasets’ elements into individual concepts: students were required to study chosen datasets and distinguish the different elements that comprise the dataset (e.g. for hotels in Thessaloniki elements include name of hotel, location, number of stars, average price etc.). (Self-driven learning, Activation, Reflection, Integration, Feedback).

- Create visualisations using open data: students were required to create at least one interesting visualization that generates added value from the open data, using the Tableau software (Demonstration, Application, Integration).
Present findings: students were required to create a website where they will document their work and findings (Reflection, Feedback, Integration).

Reflect on theory comprehension and course: students were required to answer feedback questions about each the taught materials and lab sessions, as well as assess the course’s efficiency (Feedback, Reflection).

6.1.3.3 Define assessment

The final design step regards the definition of the assessment of students’ performance. The decisions made for this step included:

- Type of assessment. Each group was assessed on their project progress, in order to avoid any misconceptions and prevent at-risk failures. Additionally, a final exam with questions and exercises on the taught material will be employed at the end of the academic semester. The group assignment comprises the 50% of the final grade and the exam the other 50%.

- Target of assessment. Students would be evaluated on a group and on an individual level. We will monitor the group’s progress during the project’s execution, as well as each student’s contribution within the group from the LA tools within Moodle. Additionally, we will evaluate each individual performance based on the student’s participation.

- Timing and location of assessment. The group assessment will be carried out across the entire project duration, where we will monitor each group interaction in the e-learning platform. The individual assessment will be carried out within the e-learning platform as well as offline during the final examination.

- Mechanisms of assessment. A number of LA tools will be employed for the students’ evaluation within the e-learning platform. Evaluation criteria will include students’ sessions in the platform, posts on forums and wikis, answers in feedback questionnaires, assignments submissions, learning resources access etc. An offline assessment mechanism will include the final exam, with questions and exercises that will cover the taught learning content on open and linked data.
6.1.3.4 Check the design

The verification of our design decisions was carried out by examining whether the activities designed and the ICT (PBL and LA) tools included within the e-learning platform could support the development of the identified competencies and comprehension of the taught learning content. We made sure that students will be able to access and navigate through existing open data in order to investigate real workplace and societal problems.

The usage of collaborative tools such as wiki will help students develop critical thinking and collaborative skills while their contribution through quizzes and feedback questionnaires will increase their reflection skills.

6.2 Trial delivery for MCs “Management Information Systems” BSc course

6.2.1 Delivery method and course structure

The course was delivered using a blended method; students were required to use the Moodle e-learning platform in order to access the learning content, upload their assignments and interact with the PBL tools during the project phase. Students also were required to study the taught learning content at home and prepare the different tasks of the group project using non e-learning tools (e.g. online open data portals, Tableau etc.).

The learning content was available to the students in the e-learning platform. More specifically, the content provided was:

**Week 4: Presenting data (slides in Greek)**

The main purpose of this week was to help students visualise and present basic and interesting findings from Open Data analysis.

This week’s learning outcomes were:

[Knowledge/Skill] Connect a story to visualised Open Data

[Knowledge] Identify tools for Open Data presentation and storytelling

[Knowledge] Identify tools for Open Data visualisation

[Skill] Use tools for Open Data presentation and visualisation

**Week 5: Analysing data (slides in Greek for Tableau, links with datasets)**
Data provided included:

- Crime data for Washington in December 2009 (local file from Tableau website)
- Bank loans (local file from Tableau website)

The main purpose of this week was to introduce students to the Tableau software so that they can access and visualize different datasets.

This week’s learning outcomes were:

[Knowledge] Understand how and where you can access open data

[Knowledge] Understand the data and their structure

[Skill] Import existing datasets into Tableau

[Skill] Create different types of graphs and visualizations with Tableau

[Skill] Document and present innovation through open data

6.2.2 The platform

The course was structured within the Moodle e-learning platform so that students will have complete and ongoing access to all learning content and resources, will be able to interact with their group members and submit their reports. The course’s structure is shown in Figure 19 “Management Information Systems” course structure in Moodle.
All activities that were designed in the design phase were supported with the inclusion of tools that underpin PBL principles. For example, tools were included, such as Wiki and Forum for collaboration, Folder for content access and self-directed learning, Assignment for demonstration and application and Feedback for Reflection.

A variety of LA tools were also employed in order to provide us with ongoing overview of students’ actions and support us being aware of any possible misconceptions or problems in understanding the taught content. More specifically, the course was supported with the LA tools shown in Table 19.

Table 19 LA tools for “Management Information Systems” course

<table>
<thead>
<tr>
<th>LA tool</th>
<th>Insights/ visualizations</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISMO</td>
<td>Resources access, forum posts</td>
</tr>
<tr>
<td>Course dedication</td>
<td>Sessions, time spent online per student</td>
</tr>
</tbody>
</table>
A more detailed description of the LA tools will be provided in D5.1.

The course is still running and thus students have not yet produced any visualizations or outputs with the datasets they have chosen.
7 AAU trial “Open Data Crash Course”

7.1 Aalborg University’s trial design

Aalborg University’s trial Open Data Crash Course was an 8-days long course taught to students of Master’s level program. The course was a part of a bigger 5 ECTS module and needed to be adjusted to the needs and requirements that the module posed. The Open Data Crash Course was meant to give students the knowledge and skills needed to work on challenges that they were presented with later in the module.

7.1.1 Understanding

In this section the trial will be described in terms of three concepts - time, context and content.

7.1.1.1 Time

The trial ran between the 19th of February and the 1st of March 2018. The course consisted of 5 days of online self-study, followed by 2 days of group work on a case, and ended with a 4-hour face-to-face lecture combined with discussion and reflection.

7.1.1.2 Context

The students attending the course came from Information Studies Master’s level programme at the Department of Communication and Psychology at AAU. At the time of the trial 8 students were enrolled at the program and all of them attended Open Data Crash Course.

AAU’s trial should be categorised as following the Living Lab course model rather than University course model (as presented in D3.1). As Information Studies program is a humanistic one, it did not have an existing course on open data nor a possibility of creating a module dedicated just to teaching open data. Instead, AAU went with the suggestion from D3.1 stating that in case of study programs other than IT “open data needs to be integrated into another existing course that has a different overall goal, suited for the discipline”. The Open Data Crash Course was chosen to be included in the 5-ECTS module ICT for Learning, Content and Knowledge Management. The module aims to “introduce students to the management and adaptation of systems for learning, knowledge and content management in order to enable students to act independently when needing to adapt systems, implement prototypes and implement more complete solutions on the basis of the adaptation and combination of components” (“Regulations and curriculum for the Master’s programme in Information Technology”, 2017). During this year’s implementation of the course, students were presented with two cases/challenges:
● How to teach and create learning materials giving non-experts an introduction to the notion of open data
● How to structure, manage and present ‘open data’ in ways that can encourage use, re-use and collaboration

The ICT for Learning, Content and Knowledge Management module ended with a 7-days written take home exam. During this year’s exam students were asked to design a fully online course for one of ODEdu’s target groups (see the text of the exam task in Appendix 1). The learning goal of the Open Data Crash Course was then for the students to gain sufficient overview of the different areas within the concept of open data in order to later be able to reflect what would be the best way of teaching and promoting it.

The course was run through the Educational and training platform designed and implemented by ODEdu project (see D3.4).

7.1.1.3 Content

The course included six of the seven areas of the University course curriculum presented in D3.1. The advanced skills area was removed, as it was not identified as one of the needs of the students from humanistic programs. Learning outcomes of the Analysing data area were modified as the complexity of the course needed to be lowered due limited time assigned for face-to-face exercises. The adapted curriculum areas from D3.1 together with learning outcomes can be found in Figure 20.

Figure 20 Curriculum areas for Open Data Crash Course
Table 20 includes the outcomes relevant to the trial together with assigned EQF level. The course aimed for EQF level 5, as the achievement of levels 6 or 7 would require including advanced curriculum areas such as programming that are not relevant for humanistic students from AAU (see Table 5 from D1.1).

Table 20 Curriculum areas for Open Data Crash Course

<table>
<thead>
<tr>
<th>Outcome</th>
<th>EQF Level</th>
<th>Skill / Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>what open data is</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>why open up data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>why I would open up my research data</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>how open data creates value</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>what the value is of open data in the social sector</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>what the impact is of open data on society, business and public policy</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>about open data licenses, why and how to apply those</td>
<td>2</td>
<td>K</td>
</tr>
<tr>
<td>which of my datasets can be used to solve a problem</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>what is considered sensitive / private data</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>how to annotate my data so that they are correctly understood</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>Question</td>
<td>Score</td>
<td>Type</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>-------</td>
<td>------</td>
</tr>
<tr>
<td>more about data formats</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>which data format is best for my users</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>What is the connection between open data and open standards?</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>about open data platforms</td>
<td>3</td>
<td>K</td>
</tr>
<tr>
<td>where to find open data that could be useful for our own processes</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>how to download and explore a dataset</td>
<td>3</td>
<td>S</td>
</tr>
<tr>
<td>how can I check the quality of my data</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>how to clean data</td>
<td>4</td>
<td>S</td>
</tr>
<tr>
<td>how the users want to access the data (dump, API, interactive table,</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>visualization, storytelling)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>which visualization is best for the type of data/user/problem addressed</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>how to do storytelling based on data</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>What are the known security issues when using open data?</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>how to provide feedback possibilities on the data</td>
<td>4</td>
<td>K</td>
</tr>
<tr>
<td>how and where to find relevant and trusted data</td>
<td>4</td>
<td>K</td>
</tr>
</tbody>
</table>
7.1.2 Alignment with pedagogical principles

7.1.2.1 Meta- and pragmatic principles

One of the requirements of the trial was for it to use PBL and LA tools that support different PBL pedagogical principles which can be divided into meta-principles and pragmatic principles. Meta-principles include: problem centred, collaborative learning, critical thinking, self-driven learning and reflection. What follows is a short description of meta-principles with explanation of how they were supported though the course design and activities.

As outlined in D2.1 there are certain steps that students need to go through when engaged in a collaborative process: a) negotiate a common understanding of the problem, b) identify learning issues and goals, c) brainstorm of preliminary project plans or a problem solution, d) continue...
rethinking and evolving their problem formulation and project plan, e) agree on the problem’s solution and f) evaluate the final solution and write down the conclusions.

Students at AAU typically spend 2-3 months working on the problem. The group work during the course was distributed over a 2-day long period. However, it can be argued that even within such a short time-frame students needed to engage in similar collaborative steps (though to a more limited extent) in order to solve the assignments as they would in case of a longer project work. Students needed to define their own problem, plan the work, and agree on the solution. Even though they were not asked to evaluate their solutions in writing, the discussion during the lecture provided them with an opportunity to reflect on their work.

As noted in D2.1 the key principles of PBL are related to one another. Engaging in collaborative learning gives the students an opportunity to ask question, participate in discussions about ideas and theories, present explanations of their perspective, investigate other perspectives. All of those activities promote and foster development of critical thinking skills. During the Open Data Crash Course one of the ways in which critical thinking principle was supported was through engaging students in collaborative learning on the case.

As explained in D2.1 self-directed learning is an ability that supports learners in regulating their own learning process, aims and priorities. In the Open Data Crash Course students were encouraged to take an active role in planning, monitoring and evaluation of their own learning process. Even though they were given the materials, it was up to them to decide when and in what order they go through them and make sure that they complete this part of the course in time. They also planned and monitored their own group work and took active part in the evaluation of solution during the group discussion.

The reflection process is one of the most important aspects of PBL (Major & Palmer, 2001) as it is one of the key elements ensuring learning within this approach. It is the task of the facilitator to scaffold the reflection process within PBL approach (see D2.1). In order to ensure reflection process of the students, a significant amount of time was assigned for a discussion during the face-to-face class at the end of the course. The discussion was facilitated by the lecturer from AAU.

Pragmatic principles are as follows: activation, demonstration, application, integration, feedback and communication (Margaryan, Bianco, & Littlejohn, 2015). Table 21 presents the mapping of PBL and LA tools, and PBL principles within AAU trial.
Table 21 Mapping of the PBL and LA tools you used in AAU’s trial with the PBL pedagogical principles that each of the tools supports

<table>
<thead>
<tr>
<th>PBL and LA tools</th>
<th>PBL principle</th>
</tr>
</thead>
<tbody>
<tr>
<td>GISMO</td>
<td>Feedback</td>
</tr>
<tr>
<td></td>
<td>Activation</td>
</tr>
<tr>
<td></td>
<td>Reflection</td>
</tr>
<tr>
<td>Analytics Graph</td>
<td>Feedback</td>
</tr>
<tr>
<td></td>
<td>Activation</td>
</tr>
<tr>
<td></td>
<td>Demonstration</td>
</tr>
<tr>
<td></td>
<td>Self-driven learning</td>
</tr>
<tr>
<td>Question Trends</td>
<td>Feedback</td>
</tr>
<tr>
<td></td>
<td>Reflection</td>
</tr>
<tr>
<td>Cases</td>
<td>Critical thinking</td>
</tr>
<tr>
<td></td>
<td>Collaborative learning</td>
</tr>
<tr>
<td></td>
<td>Activation</td>
</tr>
<tr>
<td></td>
<td>Self-driven learning</td>
</tr>
<tr>
<td>Forum</td>
<td>Collaborative learning</td>
</tr>
<tr>
<td></td>
<td>Activation</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
</tr>
<tr>
<td></td>
<td>Feedback</td>
</tr>
<tr>
<td>Discussion</td>
<td>Reflection</td>
</tr>
<tr>
<td></td>
<td>Activation</td>
</tr>
<tr>
<td></td>
<td>Communication</td>
</tr>
</tbody>
</table>

7.1.2.2 PBL components

Three main components of PBL are: the facilitator, the group and the problem, as was described in D2.1. We will now shortly describe the role of the tutor and the group in the AAU’s trial. The problem will be elaborated upon in the section 1.3.1.
7.1.2.2.1 The tutor

In the Open Data Crash Course there was one main lecturer from AAU and one guest tutor (available during the online lecture) from ODI. Even though the students had an opportunity of contacting the lecturer with any questions when going through the materials or working on the case, none of them decided to do so. All of the participants of the course have experience studying within the PBL approach, so one explanation for not contacting the lecture might be that they are comfortable enough planning and monitoring both their individual and group learning, and therefore did not have a need for a additional guidance. However, even if in this case the students did not need additional help, it is important to give students an opportunity of contacting the lecturer in the future courses. It might be beneficial to set specific time slots for supervision during which students will be able to communicate with the facilitator synchronously.

The role of the lecturers in the course turned out to be most prominent during the activities that took place on the last day of the course. Especially during the online lecture, the tutor from ODI aimed to engage “learners in key concepts, issues, and themes according to the lesson objectives” and “help learners reason effectively and develop deep understanding”, which are some of the main attributes of a PBL facilitator according to Schmidt & Moust (2005). This was done mainly by asking students to perform small tasks in small groups at different points in the lecture, such as asking students to create their own open licence with headings “you can”, “you must” or “you can’t”, which aimed to engage learners into one of the key concepts of open data, which is licensing. Learners were encouraged to justify their claims to gain the deeper understanding (Goh, 2014). Students were presented with many examples of use of open data in real world in order to engage them more into the topic of open data and how it can bring value to different sectors.

Other key attributes of the facilitator in PBL include helping learners collaborate meaningfully with their peers helping learners to be self-directed in their learning approach, helping learners to be reflective about their learning process (Schmidt & Moust, 2005). As students participating in the course are very much familiar with collaborative learning and the collaborative activities were mostly taken outside of the classroom, the lecturer did not engage in overseeing the collaboration process. Collaboration and self-directed learning were however supported by the design of the activities and the platform itself. The reflection process of the student was facilitated during the final discussion of the course.

7.1.2.2.2 The group

Even though usually the formation of the groups is often decided by the tutor (see D3.1), as the students in the course already knew each other as they attended the same programme and were familiar with PBL approach, they were asked to create the groups on their own using an activity created for them within the platform. They formed 2 groups of 3 members and 1 group consisting of
two member. The students were asked to work together over the course of two days. It was up to them to decide whether they wanted to meet face-to-face or work online and how much time they spent working on the assignment. As outlined in D3.1 it is not untypical to leave those decisions to students and let them organise their own learning process.

7.1.3 Design

7.1.3.1 The problem

The trial was designed based on the contents that were to be taught, while real life examples and a case were used to facilitate the learning process. This course was at EQF level 5 and even though asking students to define their own problems is more appropriate for the course at EQF level 6 or 7, as the participants were familiar with PBL, they were still asked to define their own problem. The lecturer set the parameters within which the problem was to be defined in line with recommendations made in D3.1. The parameters were adjusted based on the time available, the level of attainment of the course, and the learning goals.

The problem was an application one where students “use previously acquired knowledge to solve a problem” (Dolmans and Snellen-Balendong, 2012). However, even though the students were asked to define a problem that they found interesting, it was not their task to come to a specific solution due to a limited time available for the task and lack of technical experts that could facilitate their learning. They were thus meant to work more on a conceptual level and train the skills related mainly to the first step of the open data life cycle with some elements of the rest of the steps, such as explaining what data means and its value (Analysing data step).

7.1.3.2 Learning activities

The trial consisted of four main activities that supported different pedagogical principles:

Self-study using ODI materials (self-driven learning, application): The first task of the course was for students to go through the different materials (SCORM packages prepared by ODI) that were made available for them on the ODEdu platform.

Working on a problem (collaborative learning, critical thinking, self-driven learning, application, demonstration): Students were to be given an application problem that they were to work on in groups for two days. It was up to students to divide themselves into small groups and organise their own work. The groups were to write a short report including the results of their problem solving process and upload it in the ODEdu platform through Assignment Moodle activity.

Participation in a forum (critical thinking, communication, feedback):
Students were to ask questions related to OD and reply to questions asked by other students using a Moodle Forum activity.

**Face-to-face class** (critical thinking, activation, reflection, feedback, communication, demonstration):
The trial ended with a face-to-face class. The class was planned to include two lectures given by lecturers from AAU and ODI, and a discussion facilitated by the lecturer from AAU. The lectures were to focus mainly presenting real life examples of use of OD. The guest lecturer from ODI was also asked to talk about ODI’s work and experience in teaching about OD.

### 7.1.3.3 Assessment
Open Data Crash Course was a part of the larger 5 ECTS module “ICT for Learning, Content and Knowledge Management”. In this module, the final assessment is an individual, written home-exam over 7 days). This took place after the end of the teaching in the module (3rd to 10th of April). Therefore, the assessment of the knowledge gained by the students during the Open Data Crash Course was to be performed only after the larger module was completed.

### 7.1.3.4 Check the design
Before the delivery of the trial, the design was checked in order to ensure that the different aspects of the design were in line with the educational objectives. The AAU lectures performed the “usability check” (see D2.2). The design was not modified.

### 7.2 Trial delivery

#### 7.2.1 Delivery method and course structure
The course followed the Living Lab course model, but its structure differed from the example course presented in D3.1. The changes were implemented as the course needed to fit into the requirements and constraints set by the bigger module that it was a part of. Due to the organisation of the semester and module, the time available for the course consisted of 7 days when students were available online, followed by 4 hours face-to-face teaching. With this limitation put on course design, it was decided that instead of two days of teaching activities, the course would include 5 days of online self-study during which the students would organize their own learning. This was followed by 2 days during which students performed group work on a case/problem. The final part of the Open Data Crash Course was a 4-hours class. As the time assigned for the class did not seem sufficient to run a hackathon-like activity, it was the decision of the lecturer from AAU to spend most of the final day facilitating a discussion with students, thus focusing on supporting PBL principles. The timeline of the course was as follows:
19.02.2018 - 23.02.2018: During those days students were asked to go through the set of learning materials prepared by the ODI for the ODEdu project. The materials were in a form of SCORM packages embedded in the ODEdu platform (see Figure 21 and Figure 22).
The learning materials were prepared by ODI and encompassed all of the curriculum areas of the Open Data Crash Course. All materials (33 packages) were made available to students on the 19th of February and it was up to them to decide when and in what order they want to access specific packages. During that time period students were expected to use a forum entitled "Discussions about materials" to ask their fellow students at least one question regarding open data, and answer some of the questions asked by others.

27.02.2018 - 28.02.2018: The students were asked to work on a problem-oriented case related to discovering and exploring open data. The exercise was published on the ODEdu platform on the 26th and was phrased as follows:

1. Think of two issues/ business ideas you are interested in and that you believe could be solved or addressed with the use of open data. Shortly describe the issues and how you think open data could be helpful in solving them. Then try to explore different existing portals (at least 2) to find relevant data sets. Pick three different datasets (at least one for each of the issues) and answer the following questions (if you have not succeeded at finding relevant sets, just pick any data sets that you find interesting):
   - How is the data structured and what does it describe? Does the title and description match the data?
   - Who owns the data?
   - Which license applies to the data?
   - What is the star rating in Tim Berners-Lee's 5 star rating system?
   - What is the dataset value? (How could it be used? Would it allow you to address the chosen issues/business ideas? If you picked a dataset not related to a specific issue, then why did you find it interesting)?
   - Is the data too granular, too generic?
   - Is the dataset supported long term?
   - Is the data consistent?
   - Is the data clean?
   - How much effort would be required to make the data usable?

2. Shortly compare different data portals that you visited, e.g. are they all equally easy to navigate?; do they provide
sufficient information on licensing?; do they provide the data in different formats?; etc.

Students were instructed to divide themselves into groups consisting of 2 or 3 members and work on a case together. It was up to them to decide whether they wanted to work online or meet and how much time they assigned for completion of the task. The completed assignments were to be 1-2 pages long and uploaded to the platform by the end of the 28th of February.

As can be seen from the text of the exercise, the students were to define the specific problem by themselves in order to make sure that the course achieved EQF level higher than 4. Students at AAU are used to defining their own problems as was described in D2.1.

Learning outcomes of the group work:

- [knowledge] where to find open data that could be useful for our own processes
- [knowledge] about open data platforms
- [skill] how to download and explore a dataset
- [knowledge] how can I check the quality of my data
- [knowledge] how and where to find relevant and trusted data

01.03.2018: On that day students attend a 4-hour long class consisting of following elements:

1. 30-minutes long introductory lecture to the concept of open data given by a lecturer from AAU

   Learning outcomes:

   - [knowledge] why open up data
   - [knowledge] why open up my research data
   - [knowledge] what is the value of open data in the social sector

2. 40-minutes long online lecture given by trainer from ODI. The lecture focused on the use of open data in real settings and the teaching activities performed by ODI, as the information on teaching activities was deemed relevant to the students future task of designing an open data course.

   Learning outcomes:
[knowledge] about open data licenses, why and how to apply those
[knowledge] what is the impact of open data on society, business and public policy
[knowledge] what are the common barriers when teaching about open data

3. Discussion facilitated by the lecturer from AAU. The discussion aimed to help students think critically and support reflection in relation to several themes, such as: their work on the case, their learning process, the value of open data, the potential privacy problems related to opening data, what should be included in an open data course for non-technical participants and how it should be taught.

7.2.2 The platform

7.2.2.1 Platform features

The course was run through the Educational and training platform designed and implemented by ODEdu project (see D3.3).

There were several different features of the platform that were used to support the learning throughout the course.

First of all, the platform allows the tutor to upload different types of materials, such as SCORM packages or PDF files that can be viewed within the platform without the need of downloading the files (see Figure 23 and Figure 24).

![Figure 23 Screenshot from the course in ODEdu platform: view of an open SCORM package](image-url)
The **Group choice** module was implemented to facilitate students in the group creation (see Figure 25). Using this module the student was able to see which of his fellow students already signed up to a group, which groups still had a free spot and who were the members of each of the existing groups.
Moodle’s Assignment activity module was utilized in order to make it possible for students to deliver their problem solutions within the platform. The Assignment activity allows for uploading different kind of files, in this case students were asked to deliver the results of their work in a pdf format.

A Forum activity module was used to encourage students to discuss any doubts or questions that they had in relation to open data. This was supposed to facilitate their collaborative learning and critical thinking skills. Students were asked to post at least one question and answer to one of the questions posted by others.

7.2.2.2 Learning analytics

Analytics graphs

Learning Analytics plugin, specifically Analytics graphs (Content accesses) was used by the lecturer before the final face-to-face class to see which materials were viewed by students in order to prepare a lecture better fitted to the students needs (see Figure 24).
GISMO

After the delivery of the course, GISMO LA plugin was used to get an overview of accesses over time. It was specifically interesting for the lecturers to see the patterns of accessing the platform to see the materials before the face-to-face class. Lecturers were also interested to see whether the students used the platform when working on the challenges presented to them during the 5-ECTS module that *Open Data Crash Course* was a part of (see Figure 28 and Figure 29).
The AAU lecturers used GISMO also to investigate whether students accessed the slides from face-to-face lecture that were uploaded to ODEdu platform a few days after the class (see Figure 30).

**Question trends**

Question trends plugin was used to see whether students replied to the questions posed to them in the SCORM packages and whether their replies were correct or not (see Figure 31). Question trends provides this information individually for each SCORM package, therefore Configurable reports...
A plugin was used to further investigate the question answering activities throughout all SCORM packages.

Figure 30 Learning analytics plugin GISMO. Overview of students’ accesses to resources

Figure 31 Learning analytics plugin Question trends. Overview of answers for SCORM package What is Open Data
Configurable reports

Configurable reports plugin was used to gather more information on how the students performed while answering questions in different SCORM packages and what scores they received. Users report was created, including only the student users. The report included Full name column that included names of students and a column representing each of the SCORM packages (User module outline stats). The report was later downloaded in .xls format and calculations in Excel were made to investigate how many students on average attempted to answer questions in the packages or what was the average score that they achieved.

![Figure 32 Learning analytics plugin Configurable reports. Users report including User module outline stats column for each of SCORM packages](image-url)
Attendance register

Lecturers took a look at the attendance register in order to get a better overview of how much time students spent within the ODEdu platform. The information on how much time students needed to go through the available materials could be used to better organise the activities in future courses.

Heatmap

The lecturers investigated the visualisation provided by Heatmap plugin to get additional information on how often different scorm packages were viewed (see Figure 30). This further elaborates on the information provided by Analytics graph plugin, which shows only how many students accessed each package, but does not include data on how many times they did it.
Lesson 3: Open data for innovation and research

<table>
<thead>
<tr>
<th>Topic</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Starting a business with open data</td>
<td></td>
</tr>
<tr>
<td>Growing a business using open data</td>
<td></td>
</tr>
<tr>
<td>Overcoming barriers for established businesses</td>
<td></td>
</tr>
<tr>
<td>Pitching an open data business</td>
<td></td>
</tr>
</tbody>
</table>

Figure 34 Learning analytics plugin Heatmap. Fragment of the view of the main course page
8 AAU learning activity “Open Data for IT management”

8.1 Introduction to the learning activity

The ‘Open data for IT management’ was a short, blended learning activity with students from the MSc programme in IT management at the Faculty of Social Sciences, Aalborg University. Topics related to open data have not previously been taught as part of this module and semester, but the module coordinator together with the lecturers found the topic relevant to include to meet the study regulation’s objectives regarding technological and organisational innovation.

8.2 Design of learning activity

This section describes the learning activity starting by explaining its time frame, context and content.

As described above this was a short blended learning activity. The time frame was one week starting with a short face-to-face introduction to the ODEdu platform. The following week the students prepared for class by using the e-learning materials on the ODEdu platform. It was expected that the students used approximately four hours to prepare for class. The activity ended with a four hours face-to-face lecture.

Context: The ‘Open data for IT management’ learning activity was part of a 5 ECTS module titled ‘IT based improvement of organisational processes’ taught at the second semester of the MSc programme in IT management. The activity can be described as a guest lecture and this specific context influenced both the time frame and content delivered since the learning activity had to be tailored to relate to the overall module objectives.

The aim of the learning activity was to introduce the students to the area of open data and discuss the role of open data in context of business innovation. The content covered the following areas from the open data curriculum (presented in D1.1):

- Open data culture:
  - What is open data?
  - Unlocking data from open data
  - Open data: agent of change
  - Measuring success for open data
  - Open data and open data standards

- Academic practice - role of open data in innovation and research:
  - Starting a business with open data
  - Growing a business using open data
  - Overcoming barriers for established businesses
  - Pitching an open data business
8.2.1 Alignment with pedagogical principles

This introductory lecture included two overall activities: lecturing and a group exercise.

Lecturing: The lecturer presented content from the curriculum and real life cases were used to exemplify. Students were asked to prepare for class by going through the e-learning materials on the ODEdu platform (open data culture and academic practice). In addition, the students were asked to read a chapter on business model generation in a text book. This meant that the students would already have some knowledge of the topic when coming to class. An important part of the lecture was therefore to activate students’ interest and activate their prior knowledge about business innovation and link this to open data.

Group exercise: During the lecture, the students were given a group exercise. Due to the short time available, the exercise included a problem formulation and the students were given a context and a task. The exercise was formulated to support students’ teamwork, argumentation competences and critical thinking. The exercise is shown below.

Exercise about business model generation and open data

Choose one of the two cases and complete the following three steps:

1. Do a brainstorm (What is the problem? What is the user need? What is the potential of open data?)
2. Develop a business model using the business model canvas (template provided)
3. Prepare a 5 minutes pitch of your open data solution

Case A - Visit Aalborg:

There are 16.000 conference guests visiting Aalborg every year. However, very often the conference guests leave Aalborg when the conference ends.

Problem: How can we, based on open data, inspire conference guests to stay a little longer in Aalborg and visit other parts of Aalborg as well?

Suggested data sets:

- Opendata.dk (fx look at shopping streets, maps, parking, art and museums, historical photos)
- Transport data (fx rejseplanen.dk)
- Weather data (fx AccuWeather)
- Other?

Case B - Developing smart cities in Denmark:

Problem: How can open data support the development of smart cities in Denmark? The group chooses a focus area such as transport, energy, city development, art & culture, or family life.
8.3 Delivery of learning activity

As described above this was a blended learning activity. Friday the 23rd of February 2018 the IT management students were given a short, face-to-face introduction to the online materials on the ODEdu platform. Information about how to access and login to the ODEdu platform was also provided on their university learning management system. They were asked to prepare for class by going through the content on ‘Open data culture’ and ‘Academic practice - Role of open data in innovation and research’. In addition, students were encouraged to explore 1) a set of open data inspiration cards including Danish cases, and 2) more open data lessons on the ODEdu platform (curriculum areas: obtaining data, scrubbing data, analysing data, presenting data). The advanced skills lessons, however, were not made available since these social science students do not necessarily have advanced technical skills.

The four hour face-to-face lecture (in Danish) took place on Thursday the 1st of March in a lecture room at Aalborg University.

Below is a screenshot from the module, ‘Open data for IT-management’ on the ODEdu platform (see Figure 35). The module is accessible here: http://platform.odedu-project.eu/course/view.php?id=18).
The module provides access to the following content:

- An introduction to the teaching activity
- Slides (mainly in Danish) including the exercise
- Mandatory lessons:
  - Open data culture (5 SCORM packages)
  - Open data for innovation and research (4 SCORM packages)
- Optional lessons:
  - Open data in academic practice (8 SCORM packages)
  - Obtaining data (3 SCORM packages)
  - Scrubbing data (3 SCORM packages)
  - Analysing data (3 SCORM packages)
  - Presenting data (6 SCORM packages)
- A set of open data inspiration cards

An example of one of mandatory lessons is shown in Figure 36.
8.3.1 Learning analytics

This section provides an overview of the different learning analytics plugins applied.

Attendance register

Lecturers took a look at the attendance register in order to get a better overview of how much time students spent within the ODEdu platform. The information on how much time students needed to go through the available materials could be used to better organise the activities in future courses.

Analytics graphs

The Analytics graphs (Content accesses) was used by the lecturer before the final face-to-face class to see which materials were viewed by students in order to prepare a lecture better fitted to the student’s needs (see Figure 37).
The lecturers investigated the visualisation provided by the Heatmap plugin to get additional information on how often different scorm packages were viewed (see Figure 38). The heat map
further elaborates on the information provided by Analytics graph plugin, which shows only how many students accessed each package, but does not include data on how many times they did it.

Lesson 1 [mandatory]: Open Data Culture

Figure 38 Learning analytics plugin Heatmap. Fragment of the view of the main course page

Gismo

After the delivery of the course, GISMO learning analytics plugin was used to get an overview of accesses over time. It was specifically interesting for the lecturers to see the patterns of accessing the platform to see the materials before the face-to-face class. Lecturers were also interested to see whether students used the platform after the learning activity had ended (see Figure 39).
Figure 39 Learning analytics plugin Gismo. Overview of platform accesses over time

The evaluation of the learning activity can be found in D5.1.
9  AAU learning activity “Computing Infrastructure Management”

Introduction to the learning activity

The “Computing Infrastructure Management” is a 5-ECTS module aimed for Master’s level students in the Service System Design programme, taught at Aalborg University’s Copenhagen campus. As part of the module, students learn about the main current trends in IT, e.g. Big Data, Open Data, IoT. In the next iteration of the module, in the spring of 2019, materials developed by ODEdu will be incorporated into the course to support students in learning about OD.

1.1  Understanding

This section describes the learning activity, its time frame, context and content.

1.1.1  Time

The “Computing Infrastructure Management” module will take place in the spring semester of 2019. The course will consist of two frontal lectures and two assignments, the students are expected to spend around 5 hours working on the assignments. Afterwards, students will participate in a 2-day long data workshop. The course will end with an individual written report and an oral exam (20 minutes per student).

1.1.2  Context

The “Computing Infrastructure Management” will be a 5-ECTS module belonging to Service Systems Design programme at Aalborg University’s Copenhagen campus. In this programme, students from the 2nd semester learn how to plan and organise infrastructure, people, communication, media, as well as, components of a service, with a goal of improving quality of that service and customers’ experience associated with it.

In the module students will be examining the concept of infrastructure management from two perspectives: a perspective referring to computer science and one referred to industrial production. When it comes to the IT aspect, the focus is put on gaining a deeper understanding of online distributed service solutions, accessible through different operating systems and devices. An emphasis will be put on how data is used and what its role is in the design of living services. Students will be made familiar with different concepts or trends, such as Big Data, Open Data or IoT. This focus that is given to data in general, and OD in particular, means that the products of ODEdu Project are a valuable addition to the module, and will be incorporated into relevant activities.

The particular theme for the students’ projects during the next iteration of the “Computing Infrastructure Management” will be inspired by Future and Emerging Technologies (FET) Proactive project “WeNet - The Internet of US”:
“Technology does not in-and-by-itself provide support for developing and maintaining the social relationships that transcend geographical and cultural backgrounds. WeNet addresses this gap by providing a diversity-aware, machine-mediated paradigm of social relations. The goal is connecting people that can support each other, and the key is leveraging their diversity”.


The module will be a blended activity, partly implemented within the ODEdu Project’s Educational and training platform (see D3.3). 35 students are currently enrolled at Service Systems Design programme, and as the module is mandatory, they are all expected to participate in it.

1.1.3 Content

The “Computing Infrastructure Management” module will include elements from five of the seven areas on the University course curriculum (see D3.1):

- Culture
- Open Data Lifecycle:
  - Obtaining data (e.g. Finding data, Data formats)
  - Scrubbing data
  - Analysing data (e.g. Interpret data, Explain what data means and its value)
  - Presenting data (e.g. Creating visualisations, Storytelling with data)

In a preparation for and during the data workshop, students will go through some of the steps of the Open Data Lifecycle area of the curriculum. The main focus will be given to data exploration, sensemaking and creating visualisations. The module will use some of the SCORM packages developed by ODI for ODEdu and draw inspiration from the courses already available in the ODEdu Project’s platform, e.g. Introduction to Open Data, Better Data Better Decisions, Open Data Crash Course, Open Data Formats.

1.2 Design

1.3 1.2.1 Course structure and learning activities

The “Computing Infrastructure Management” module will consist of several different activities:

- Two preparatory lectures,
- Two assignments,
- Data workshop,
- An exam report,
An oral exam.

What follows, is a short description of both of the assignments and the data workshop activity.

Assignments

The two assignments are meant as a preparation for the workshop and will happen prior to it. Overall, it is expected that the students will spend around 4-5 hours working on the assignments. The goal of the first assignment will be to get the students started on the data collection process. Students will be asked to explore Twitter as a potential data source within the main theme of the module and submit two machine-readable lists, one of them consisting of keywords/hashtags, and the other of Twitter users.

In the second assignment, students will be asked to work on a dataset related to the Titanic catastrophe, with a goal of finding insights that they will later turn into a data story. Students will be asked to submit their data story in a format of their choice, e.g. slide or poster, together with a short (150-200 words) written description of their process and outcomes.

Data workshop

The general aim of the workshop will be to familiarise students with tools useful for working with data that do not require programming skills. During the 2-day workshop, students will be asked to explore the data and go through the sensemaking process. The workshop will start with student exploring the collected data and then developing research questions and hypotheses to be addressed with the help of data. Students will be asked to prepare presentations for the end of the workshop, including the main insights that they gained while working with data.

1.2.2 Assessment

The module will end with an exam consisting of both written and an oral part. The students will be expected to hand in a paper in order to be allowed to participate in the oral exam. The written and the oral parts will be of equal importance, with each of them counting for 50% of the final grade. The paper is expected to address the main theme of the course ("WeNet - The Internet of US"), while the oral exam will cover the whole curriculum of the module.

1.1.3 Platform and tools

The course will be implemented in the ODEdu platform, meaning that it will have access to all the Learning Analytics tools that were incorporated into the platform (see D3.3):
● GISMO,
● Question Trends,
● Configurable Reports,
● SmartKlass,
● Inspire,
● Attendance Register,
● Analytics Graph,
● Heatmap.

During the course, students will also have a chance to familiarise themselves with some of the following tools meant for working with data:

● Excel,
● Google Sheets,
● OpenRefine,
● RAWGraphs,
● Tableau,
● D3.js,
● Gephi,
● Google Fusion Tables,
● Carto.

1.2.3 Alignment with pedagogical principles

During the module, students will be taking part in several activities. First of all, they will participate in two lectures introducing them to different concepts related to infrastructure management and working with data. The students will later activate the knowledge gained from the lectures and self-study while working on the assignments and participating in the workshop.

During the workshop, the participants will also have a chance to apply in practice the skills and the knowledge gained during the preparation activities, namely the lectures and the assignments.

Students will gain multiple opportunities to demonstrate the insights, skills, and knowledge that they gained, as they submit different products, of their work, e.g. data story, small written tasks, workshop presentation, or final exam report.

Students will be provided with feedback throughout the module, to support their learning process. Their final grade will depend on their written and oral exams, during which they will have to show that they managed to think critically and be reflective in their work. The oral exam will also give the participants an opportunity to demonstrate and communicate what they have learned, as well as gain valuable feedback.
10 Educational and training events

This section provides feedback on any other educational and training events outside of the formal university course paradigm. Such events will include hackathons, webinars, seminars, workshops etc.

10.1 UOM: Learning activity MSc “IT and Law” course

UOM designed and delivered a learning activity within the elective course “IT and Law”, which is taught at the 2nd semester of the postgraduate program of the Applied Informatics department at UOM. The PBL approach was applied within an assignment where each student had to present an idea or analysis that showed Open Data’s added value.

The learning activity was carried out offline, and thus no LA support was provided. A total of 7 hours were used to introduce students to Open Data and to basic components of obtaining and visualizing data. More specifically, units of learning from the ODEdu curriculum skeleton included:

- Introduction to Open Data
- Obtaining Open Data
- Cleaning Open Data
- Presenting Open Data

In total, 10 students participated and performed individual assignments. The assignment regarded the creation of a story that showcases the added value of Open Data.

10.2 UOM: MOOC on Open and Linked Data

UOM coordinated with the Delft University of Technology in Delft, Netherlands during the d.go 2018 Conference towards the creation of multiple videos that will be used within a future MOOC on Open Data and Open Data education.

The videos created have been uploaded on Youtube as shown in and are available for viewing, as shown in Table 22 and Figure 40.

Table 22 Videos created for MOOC on Open Data

<table>
<thead>
<tr>
<th>Video title</th>
<th>Presenter</th>
<th>Video link</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application Interfaces</td>
<td>E. Tambouris (UOM)</td>
<td><a href="https://youtu.be/5xu2AZ6N2Hc">https://youtu.be/5xu2AZ6N2Hc</a></td>
</tr>
<tr>
<td>Linked Open Data I</td>
<td>E. Tambouris (UOM)</td>
<td><a href="https://youtu.be/ssJlbvyEN9g">https://youtu.be/ssJlbvyEN9g</a></td>
</tr>
<tr>
<td>Linked Open Data II</td>
<td>E. Tambouris (UOM)</td>
<td><a href="https://youtu.be/Dn7Vav6g66M">https://youtu.be/Dn7Vav6g66M</a></td>
</tr>
</tbody>
</table>
The MOOC will be created in the future and will be available for enrolment to a wide range of participants.

10.3 UOM: Datathon 2018

UOM organized and hosted a Datathon contest within the University facilities on 20\textsuperscript{th} of May 2018 at 09:00am. The Datathon lasted 12 hours and aimed to support the development of new business ideas and applications based on Open Data\textsuperscript{1}. The contest was organized by students of the “Project Management” course (35 students, 7 groups) as a group assignment.

In the morning, all participating groups were given datasets in different formats (csv, xls, xml etc.) and APIs and SPARQL endpoints for usage. The datasets covered many different fields for investigation. The groups were required to work with the given datasets and search how to produce added value through their exploitation. Each group had to think of innovative ideas to use the

\textsuperscript{1}
datasets by obtaining, combining, analyzing and creating visualizations that will highlight the benefits and inventive nature of the idea.

In the afternoon, each group presented their idea or application and a committee of University teachers assessed the best ideas for awards. The award regards a certification for their distinction.

In total, six participants were enrolled in the contest and three winners were awarded. Figure 41 shows a picture from the event.

![Figure 41 UOM Datathon](image)

**10.4 UOM: Open Data tutorial**

UOM hosted a tutorial / workshop within the dg.o conference “19th Annual International Conference on Digital Government Research”. The tutorial was carried out on the 30th of May with 7 participants. Figure 42 shows a picture of the event.
This was a 3-hour tutorial which consisted of short presentations, a hands-on session and time for discussions. The tutorial programme followed.

1. Welcome and tour de table of participants.
2. Brief presentation of the ODEdu project.
3. Discussion with the participants on similar experiences.
4. Presentation of Open Data curriculum, learning content and the university and VET Open Data course models.
5. Presentation of the lessons learnt from the projects outputs application in universities and companies.
6. Q&A session; Discussion with the participants.

### 10.5 UOM: 2\textsuperscript{nd} Datathon

UOM organized a second datathon event, following the event hosted on the 20\textsuperscript{th} of May 2018. The datathon was hosted at 16\textsuperscript{th} of December 2018\footnote{https://datathonuom.wixsite.com/2018/w-e} at the premises of UOM. Figure 43 shows a
screenshot of the website that includes the registration form, information about the Datathon and the schedule for the event.

![Website for the 2nd UOM datathon](image)

**Figure 43** Website for the 2nd UOM datathon

The schedule for the day of the Datathon was as follows:

10:00am - 10:30am: Registrations

10:30am - 11:00am: Short event presentation

11:00am - 2:00pm: Working groups

2:00pm - 2:45pm: Break

2:45pm - 5:00pm: Working groups

5:00pm - 6:00pm: Group results presentations

6:00pm - 6:40pm: Evaluation committee

6:40pm - 7:00pm: Awards ceremony

In total, the event had 23 participants and 8 working groups were formed. The following Figures show images from the event.
The winning team presented an application for identification of parking spaces for disabled citizens, as shown below.
The mobile application was developed for Android Smartphones and is available on Google Play. The group members intend to extend the application and make it available for iPhones as well. The datasets used are available on [http://www.data.gov.gr/](http://www.data.gov.gr/) and include mostly geographical data.

Second place was awarded to the team that created a device named Arduino, with capabilities of GSM network. This device can measure temperatures, humidity, smoke and fire levels. There is the ability to upload measurements of the above freely on the internet for constant update of the situation of fires and to notify the local authorities when the measurements overcome the safe limits.

![Mobile application for finding parking spaces for disabled citizens](image)
The datasets used are:

- http://opendatagortynia.gr/dataset/forest-fires

Other applications created by the rest of the groups include games for cultural and history education, notification of car accidents history, measurement of quality of life etc.
Conclusions

This report elaborated on the preparatory work carried out for the implementation of the university pilots. Moreover, the report provided descriptions of the process, including information such as the methodology followed, the learning methods and materials used, the duration of the pilots, practical applications, engagement learning methods etc.

The report also described events that took place and where academic stakeholders participated. More specifically, UOM carried out datathons, workshops and created a MOOC on Open and Linked Data. The VET partners also carried out such events, as described in D4.2. The following Table provides an overview of the pilots and events that have been completed, are currently running or are scheduled to start after the project’s end.

<table>
<thead>
<tr>
<th>Main partner</th>
<th>Activity description</th>
<th>Status</th>
<th>Target groups</th>
<th>Number of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>AAU</td>
<td>Open Data Crash Course</td>
<td>Complete</td>
<td>Uni students</td>
<td>8</td>
</tr>
<tr>
<td>AAU</td>
<td>Social science students in eGovernment and innovation</td>
<td>Complete</td>
<td>Uni students</td>
<td>30</td>
</tr>
<tr>
<td>AAU</td>
<td>Two online modules aimed at Danish municipality employees</td>
<td>In progress</td>
<td>Municipality employees</td>
<td>Ongoing</td>
</tr>
<tr>
<td>UOM</td>
<td>Advanced Information Systems (BSc course)</td>
<td>Complete</td>
<td>Uni students</td>
<td>9</td>
</tr>
<tr>
<td>UOM</td>
<td>Management Information Systems</td>
<td>In progress</td>
<td>Uni students</td>
<td>238</td>
</tr>
<tr>
<td>UOM</td>
<td>BSs eGovernment</td>
<td>Complete</td>
<td>Uni students</td>
<td>16</td>
</tr>
<tr>
<td>AAU</td>
<td>PBL model tutorial video</td>
<td>Complete</td>
<td>Everyone</td>
<td></td>
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<td>Uni students</td>
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<td>Participation in MOOC</td>
<td>In progress</td>
<td>Everyone</td>
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<td>Everyone</td>
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<td>Scoped</td>
<td>Uni students (master in service systems design)</td>
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References


Appendix 1 - Text of the take-home exam (ICT for Learning, Content and Knowledge Management module)

| Case - Designing an Open Online Course on Open Data Training |

In the European Project ERASMUS+ project ODEdu (http://odedu-project.eu) there is a work package in which partners are tasked with developing trial courses on open data within academia (teachers/students), the public sector or for private employees. As a participant in the project you have been given the task of designing a fully online course for one of these target groups (you decide which). The course must be fully online as participants can be scattered across a country (or countries) and will need flexibility in when to attend the course. Due to the nature of the project there needs also to be a focus on active learning and/or elements of PBL in the course.

The target group within each of the three areas (academia, public sector, private sector) is quite broad and could be people already working with data or making data available, as well as people within communication jobs that may have to explain, communicate or write up press briefings, website texts etc. about Open Data; or it could be employees in companies who would like to utilize Open Data for commercial purposes. The needs of these groups were covered in deliverable 1.1 in the project (http://odedu-project.eu/project-deliverables/), and also there are already reports available on PBL and open data, as well as outlines and ideas for courses within these domains (see previous link).

Thus, based on all this existing knowledge your task is now to create a learning design for an Open Online Course for one of the three target groups. In all cases the courses are not as such formally accredited, but will yield a diploma, badge or the like. For the same reason learners are only expected to be able to spend 3-6 hours pr. week over 6-12 weeks (you decide the length). You do not need to actually implement the course in a system, but you will need to outline some ideas for how you would technologically support the course and the learning activities in the course.

In the written report you could include/cover the following points and think of it as an expanded and more theoretically grounded version of the small assignment you made as part of the course.

- What is the context of your proposed learning design – who is the target group and what are their needs?
- What are your underpinning pedagogical values or the learning theory that you base your design on (e.g. use the text by Conole et al.) i.e. how do you theoretically underpin your design?
- What are the learning outcomes of the course and the learning activities in the course?
- What are the learning activities people should engage with (alone, together)?
- What is the content that they should work with, and how does this content respond to
their needs (for the content you are welcome to reference/use the learning material provided by ODI in the ODEdu project – i.e. you can state what material you think they should go through)

- How is the course and the learning activities structured (i.e. what are the learners supposed to do, in what order, with whom, is there a teacher)?
- How would you technologically implement it (e.g. using a learning management system such as Moodle, CMS system like Wordpress, using Google services, using social media etc.)
- How do you imagine a particular user would approach it?
1附件 A – [name]