

**Project:** Boosting the telecommunications engineer profile to meet modern society and industry needs [BENEFIT]

**Project ID:** 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP

**Work Package 3:** Modernization of teaching methodologies and infrastructures

**Title:** D3.3 Collection of teaching material for new and modernized courses

**Lead Organization:** FERIT

**Participating Organizations:** UNI-KLU, UL, UBL, UNSA, UNTZ, UB, UNI, UNS, ENT, BICOM, BIT, CISCO, NiCAT, RT-RK

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Deliverable data	Work Package and Outcome ref.no.	WP3 D3.3
	Title	Collection of teaching material for new and modernized courses
	Type	<input checked="" type="checkbox"/> Teaching material <input type="checkbox"/> Event <input checked="" type="checkbox"/> Learning material <input checked="" type="checkbox"/> Report <input checked="" type="checkbox"/> Training material <input type="checkbox"/> Service / Product
	Description	<p>The teaching material is prepared and provided in electronic form for all the modernized courses (selected in WP2) and enriched with teaching methodologies (selected in D3.1). Final teaching material is available as part of the web repository for class material and remote classes (within D3.4 as a web service). The report describes the teaching material, which will be made available in the WB partner countries' languages to promote integration. Part of the teaching material will be prepared also in English to foster internationalization.</p>
	Date	14/04/2020
	Language	English and Bosnian (Croatian/Serbian)
Target groups	<input checked="" type="checkbox"/> Teaching staff <input checked="" type="checkbox"/> Students <input checked="" type="checkbox"/> Trainees <input type="checkbox"/> Administrative staff <input checked="" type="checkbox"/> Technical staff <input checked="" type="checkbox"/> Librarians <input checked="" type="checkbox"/> Industry partners, WB Higher education authorities	
Dissemination level	<input type="checkbox"/> Department / <input type="checkbox"/> Local <input type="checkbox"/> National <input type="checkbox"/> Faculty <input type="checkbox"/> Institution <input type="checkbox"/> Regional <input checked="" type="checkbox"/> International	
Lead Organization	FERIT	
Participating Organizations	UNI-KLU, UL, UBL, UNSA, UNTZ, UB, UNI, UNS, ENT, BICOM, BIT, CISCO, NiCAT, RT-RK	

Revision History				
Version	Date	Author(s)	Organization(s)	Brief description of change
01	03/04/2020	V. Delić, V. Križanović	UNS, FERIT	Sections 1 and 2, Section 3
02	07/04/2020	V. Križanović, Z. Krpić, D. Došen, I. Lukić, A. Mujčić, N. Jakovljević	FERIT, FERIT, FERIT, UNTZ, UNS	Contributions to Section 3 and Section 4
03	14/04/2020	A. Tonello, M. Zajc, D. Žagar, N. Suljanović, V. Delić	UNI-KLU, UL, FERIT, UNTZ, UNS	External review revisions
release 1	01/09/2020			
release 2 proofread	09/02/2021		Sinonim d .o.o.	Proofreading

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## 1. Introduction

The deliverable D3.3 “Collection of teaching material for new and modernized courses” reports the teaching material which is prepared and provided in electronic form for all the modernized courses (selected in WP2) and enriched with teaching methodologies (adopted in D3.1). Final teaching material is available as part of the web repository for class material and remote classes (within D3.4 as a web service). The relationships with other deliverables and WPs are shown in Figure 1.



Figure 1. *D3.3 among other WP3 deliverables, relation to other WPs and contributions to the project goals*

The collection of teaching material for new and modernized courses is based on inputs from WP2 (selected courses) which are modernised by adoption of both the new teaching methodologies (described in D3.1) and the modern equipment (acquired for 6 joint university-industry labs – presented in D3.2), contributing to the web service (D3.4) and altogether to the three main project goals:

- G1:** Modernize teaching methodologies by adopting new learning/teaching methods.
- G2:** Upgrade the lab infrastructure through the development of new thematic joint industry-academia labs.
- G3:** Increase the attractiveness of ICT studies through the development of a joint e-platform.

The report describes the teaching materials, which are made available in the WB partner countries’ languages to promote integration. Part of the teaching materials will be prepared also in English to foster internationalization and increase visibility of the BENEFIT project.

The deliverable D3.3 is organized in six sections. After the Introduction with relation to other WPs and contributions to the three main project goals, Section 2 describes the objectives of the deliverable D3.3. Section 3 gives an overview of the Teaching Material Web Repository, including the course materials interface, teaching material upload interface, the repository interface, as well as the requirements for storage space for the courses. Section 4 gives an overview of collected teaching materials with the description of the organization and content of the web repository. The summary and main conclusions are drawn in Section 5. The final Section 6 is the list of references.

## 2. Objectives of the Deliverable

The main objectives of the deliverable are to adopt new teaching methodologies and modern equipment in order to develop a collection of teaching materials for new and modernized courses selected at 6 WB universities, and to make them available as a web service. Apart from new learning/teaching methods selected from the available literature, the BENEFIT project has developed several new learning/teaching methods in cooperation with industrial partners, as well as a new method of audio libraries based on automatic text-to-speech technology in Serbian, Bosnian and Croatian languages. The report describes the web repository, how it is organized, as well as its content.

## 3. Teaching Material Web Repository

The Teaching Material Web Repository is aimed to collect class and lab sessions material, recorded remote classes and network of audio libraries based on new text-to-speech technologies. The teaching material, including video recorded classes, could be collected in multiple languages. This content is primarily prepared for the students and teaching staff at the universities participating in the BENEFIT project, but it is also publicly available without any restrictions.

As part of the Main Central Web Platform (Figure 2), the Teaching Material Web Repository is available at: <https://www.project-benefit.eu/eplatform/?materials#5>



Figure 2. Link to the Teaching Material Web Repository

The creation and delivery of the web repository and platform is led by FERIT. Each WB HEI partner should internally manage the upload of new teaching material on the web repository.

Before uploading new teaching material to the web repository, collection of preliminary teaching material for new and modernized courses, as well as translation of preliminary teaching material should be completed.

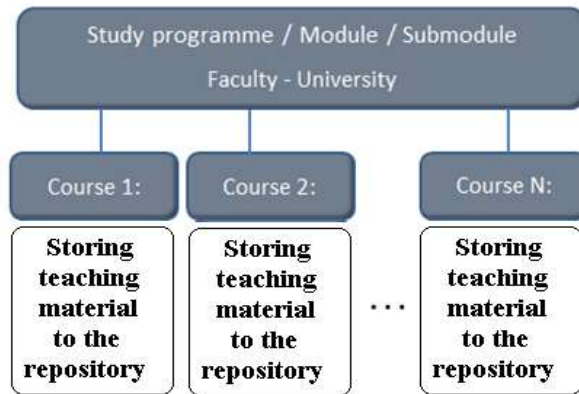


Figure 3. *The structure of class material storing within the web repository*

To facilitate accessibility and promote internationalization, the collected teaching material can be offered in Bosnian/Croatian/Serbian and English languages. The update of lectures and training materials should allow students, trainees and teachers to easily retrieve information and simplify the teaching and learning processes.

The teaching materials are firstly classified according to the related ICT study programme, as presented in Figure 3, Figure 4, and Figure 5. By selecting the appropriate study programme, all the courses within it are listed.

For demonstration purposes, this list is populated for some of the test courses.

The screenshot shows the BENEFIT website interface. At the top, there is a logo on the left and the text 'BENEFIT Boosting the telecommunications engineer profile to meet modern society and industry needs' on the right. Below this is a navigation bar with links: Home, ICT study programmes, Teaching materials (highlighted), Universities, Industry catalogue, Industry information portal, and About.

The main content area is divided into two columns. The left column is titled 'Teaching materials (BSc)' (circled in red) and lists four items:
 

- Acoustics and Audio Technique - Test repository (Faculty of Electrical Engineering - University of Banja Luka)
- Acoustics and Audio Technique - Teaching materials (Faculty of Electrical Engineering - University of Banja Luka)
- Fundamentals of Speech Communication - Lectures (School of Electrical Engineering - University of Belgrade)
- Fundamentals of Speech Communication - Exercises (School of Electrical Engineering - University of Belgrade)

The right column is titled 'Teaching materials (MSc)' (circled in red) and lists one item:
 

- IoT Networks - Materials (School of Electrical Engineering - University of Belgrade)

Two red arrows point from the 'Teaching materials (BSc)' and 'Teaching materials (MSc)' headers towards a yellow box labeled 'Study programmes' located between the two columns. At the bottom left, there is a logo for the Erasmus+ Programme of the European Union, with the text 'Co-funded by the Erasmus+ Programme of the European Union'. Below this, it says 'Web: Project information: http://benefit.ferit.hr' and 'Erasmus+ Project BENEFIT, 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP'. At the bottom right, there is a link for '[Administration]'.

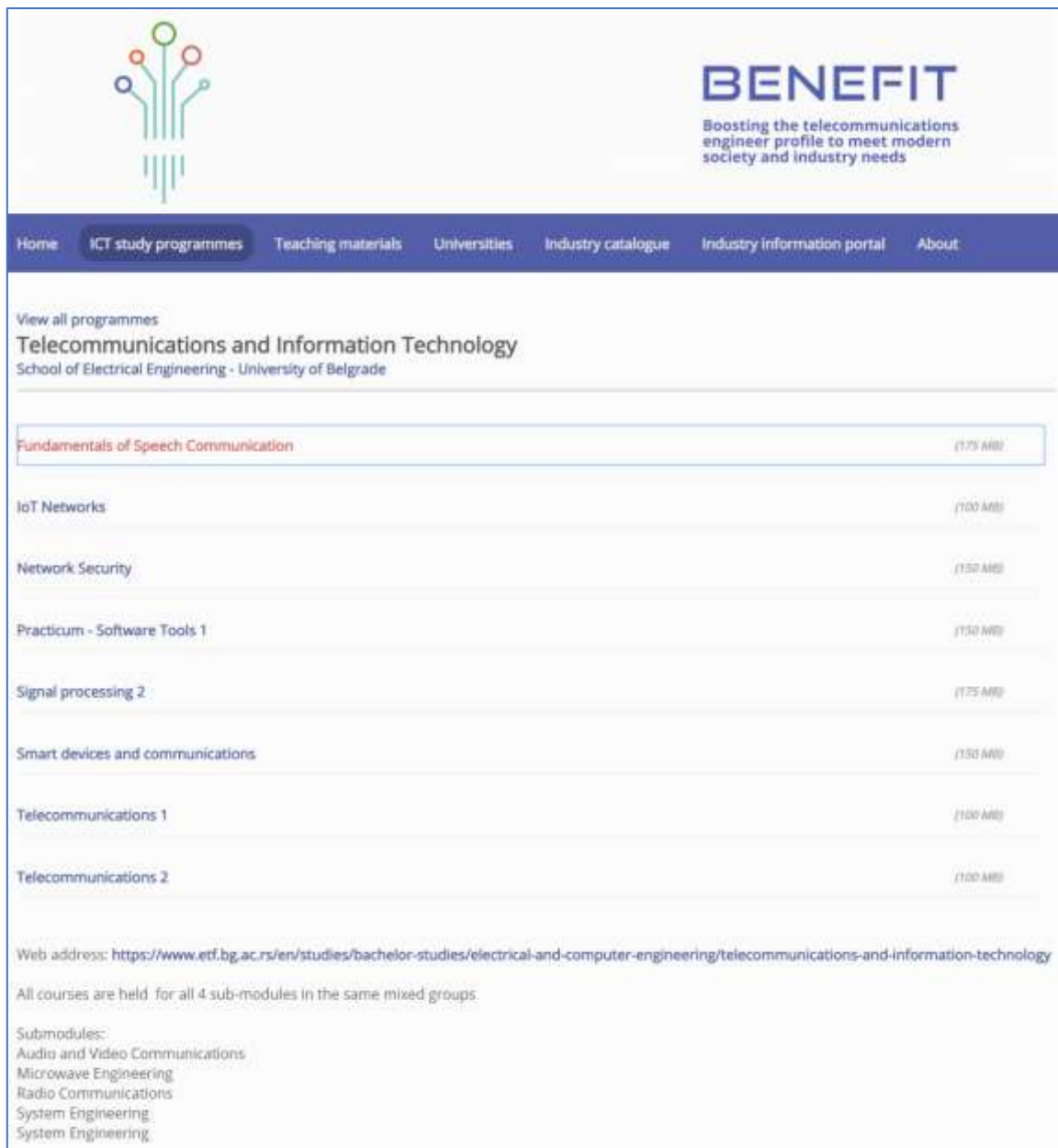
Figure 4. Classification of the teaching material according to the type of study programmes

The following is presented within this list:

- enhanced selected courses in ongoing study programmes, and
- new specific-knowledge courses

When a user clicks on a specific course, and then on “View all programmes”, the interface which contains the list of all courses within the selected study programme appears, as shown in Figure 5.





The screenshot shows the BENEFIT website interface. At the top left is a logo with colorful circles and lines. To the right is the text 'BENEFIT' and 'Boosting the telecommunications engineer profile to meet modern society and industry needs'. Below this is a navigation bar with links: Home, ICT study programmes (highlighted), Teaching materials, Universities, Industry catalogue, Industry information portal, and About.

The main content area is titled 'View all programmes' and 'Telecommunications and Information Technology' from the 'School of Electrical Engineering - University of Belgrade'. It features a table of courses:

Fundamentals of Speech Communication	(175 MB)
IoT Networks	(100 MB)
Network Security	(150 MB)
Practicum - Software Tools 1	(150 MB)
Signal processing 2	(175 MB)
Smart devices and communications	(150 MB)
Telecommunications 1	(100 MB)
Telecommunications 2	(100 MB)

Below the table, the web address is provided: <https://www.etf.bg.ac.rs/en/studies/bachelor-studies/electrical-and-computer-engineering/telecommunications-and-information-technology>. A note states: 'All courses are held for all 4 sub-modules in the same mixed groups.' The submodules listed are: Audio and Video Communications, Microwave Engineering, Radio Communications, System Engineering, and System Engineering.

Figure 5. *The structured list of courses*

### 3.1. Course Materials Interface

By clicking on each of the courses, the course content is shown (as in Figure 6). The following data on the course material is available:

- list of repositories,
- list of files within each of the repositories
- file sizes
- date of the latest update of each of the repositories
- course description, and
- university which offers the course.

The course material is divided into repositories. The two repositories shown in Figure 6 are Lectures and Exercises. It is advised that the names of the repositories correspond to the classification which is used throughout the Teaching materials interface, as follows

- Lectures
- Exercises
- Practice

However, arbitrary names are allowed so that the need for specialized content can be met.

The screenshot shows the BENEFIT web repository interface. At the top, there is a logo for BENEFIT with the tagline "Boosting the telecommunications engineer profile to meet modern society and industry needs". Below the logo is a navigation menu with links: Home, ICT study programmes, Teaching materials, Universities, Industry catalogue, Industry information portal, and About. The main content area displays the course "Fundamentals of Speech Communication" from the University of Belgrade. There are two repository sections: "Lectures" and "Exercises". Each section lists files and their sizes. The "Lectures" repository has three files: "Description of the lectures: ..." (15.12.2018), "Teaching methods.pdf" (563.83KB), and "Celebration of learning.gif" (33.12KB). The "Exercises" repository has three files: "Description of the exercises: ..." (15.12.2018), "Learning process.pdf" (529.49KB), and "Learning.gif" (80.49KB). Below the repositories is a "Course description" section with a link to the course page: [https://www.ef.zg.ac.rs/en/ris/karton\\_predmeta/13E933OGK](https://www.ef.zg.ac.rs/en/ris/karton_predmeta/13E933OGK). At the bottom, there is a logo for the Erasmus+ Programme of the European Union and project information: "Web: Project information: <http://benefit.ferit.hr>" and "Erasmus+ Project BENEFIT: 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP". There is also a link for "[Administration]".

Figure 6. Overview of the web repository space for teaching material

If a person responsible for a course opens the course interface, additional options become available. These options are editing and deleting each of the course repositories, as shown in Figure 7.

The screenshot shows the BENEFIT web repository interface. At the top left is a logo with colorful circles and lines. To the right, the text reads "BENEFIT Boosting the telecommunications engineer profile to meet modern society and industry needs". Below this is a navigation menu with items: Home, ICT study programmes, Teaching materials, Universities, Industry catalogue, Industry information portal, and About. The main content area is titled "Fundamentals of Speech Communication" and is associated with the "University of Belgrade". It includes links for "View all courses", "Edit course", and "Add repository". There are two sections for teaching materials:

Section	Description	Files	Date	Actions
Lectures	Description of the lectures: ... Teaching methods.pdf Celebration of learning.gif	563.83KB 33.12KB	15.12.2018.	edit / delete
Exercises	Description of the excersises: ... Learning process.pdf Learning.gif	539.49KB 86.49KB	15.12.2018.	edit / delete

Below the materials is a "Course description" section with a URL: [https://www.etf.bg.ac.rs/en/vtis/karton\\_predmeta/13E033OGK](https://www.etf.bg.ac.rs/en/vtis/karton_predmeta/13E033OGK). At the bottom, there is a logo for the Erasmus+ Programme of the European Union, project information, and a search bar with "[Accounts]" and "[Logout]" buttons.

Figure 7. Overview of the web repository space for teaching material, for the course admin (editable)

If a user clicks “Delete”, a dialog box appears for confirmation of deleting a repository. By clicking “Edit” a teaching material upload interface appears.

### 3.2. Teaching Material Upload Interface

The menus for the description and upload of the prepared teaching material within the designed repository are presented in Figure 8.

The “Add Files” dialog box allows file upload by dragging them to the “Drag and Drop Files” area (item 1 in Figure 8). Alternatively, it can be done by clicking the button “Add Files” and browsing/selecting them locally. When uploading a file, files can be sorted according to their classification (lectures, exercises, practice) and a short description of the uploaded file can be added. During the file upload, a brief progress bar shows up below the “Add Files” button (item 2 in Figure 8).

The screenshot displays the BENEFIT web interface. At the top, there is a logo and the text 'BENEFIT Boosting the telecommunications engineer profile to meet modern society and industry needs'. A navigation bar includes links for Home, ICT study programmes, Teaching materials, Universities, Industry catalogue, Industry information portal, and About. The main content area is for the course 'Fundamentals of Speech Communication' at the University of Belgrade. It features a 'View all courses' link, 'Edit course' and 'Add repository' options, and a 'Lectures' section. A 'Description of the lectures: ....' field is present, along with an 'Add Files (max 500MB per file)' button and a 'Drag & Drop Files' area. Below this, there are two files listed: 'Teaching methods.pdf (563,83KB)' and 'Celebration of learning.gif (33,12KB)'. A 'SAVE CHANGES' button and a 'Back' link are also visible. The 'Course description' section contains a URL: 'https://www.etf.bg.ac.rs/en/fls/karton\_predmeta/13E033OGK'. A red box labeled '1' highlights the 'Add Files' dialog box, and another red box labeled '2' highlights the list of uploaded files, including '1). test.txt (0.01 KB)' with a 'Delete' button. At the bottom, there is a logo for the Erasmus+ Programme of the European Union, a 'Web' link, 'Project information', and a dropdown menu with '[Accounts]' and '[Logout]' options.

Figure 8. Web repository space for teaching material upload

Additionally, the list of already uploaded materials can be found below the “Add Files” dialog box. By clicking each of them, the user can download or open the files. There is an additional “Delete” button on the right of each of the file that allows the user to delete the material. A confirmation dialog box appears so that the user cannot delete the file unintentionally.

Finally, when a user wants to save or discard the changes made to the repository of the course, the options are either to click the “SAVE CHANGES” button or to click “Back”. The page for uploading the teaching material also contains the description of the course.

The interface shown in Figure 13 also has the “Add repository” link which opens the interface shown in Fig 9.



**BENEFIT**  
Boosting the telecommunications engineer profile to meet modern society and industry needs

Home ICT study programmes Teaching materials Universities Industry catalogue Industry information portal About

View all courses

**Fundamentals of Speech Communication** *University of Belgrade*

Edit course |

Repository title..

Repository description..

**ADD REPOSITORY** Back

Course description

[https://www.etf.bg.ac.rs/en/fis/karton\\_predmeta/13E033OGK](https://www.etf.bg.ac.rs/en/fis/karton_predmeta/13E033OGK)

 Co-funded by the Erasmus+ Programme of the European Union

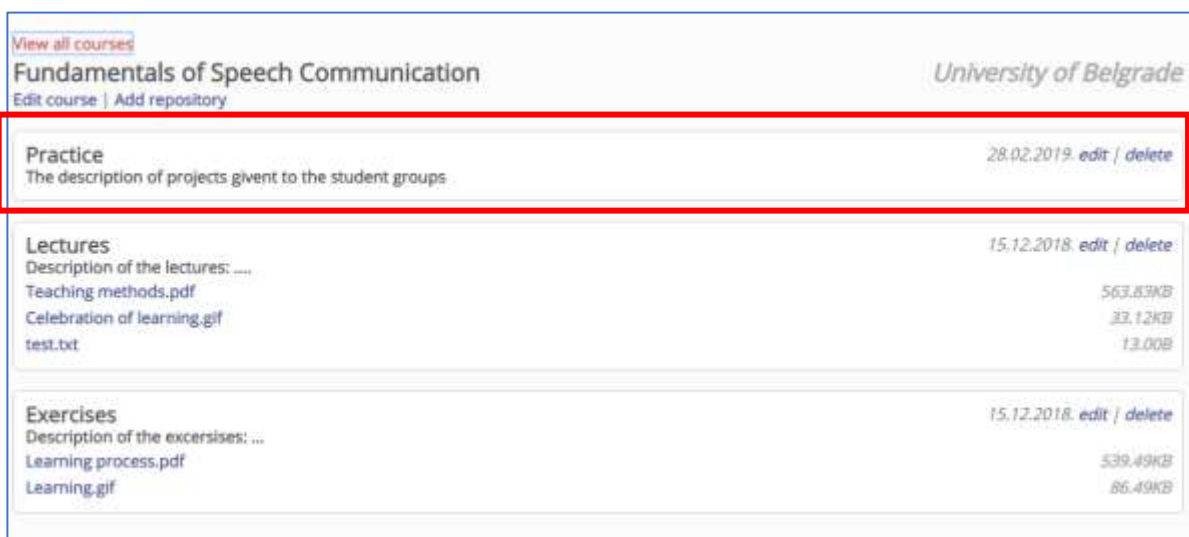
Web: <https://www.project-benefit.eu/eplatform/>  
Project information: <https://www.project-benefit.eu>  
Erasmus+ Project BENEFIT, 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP

[Accounts] [Logout]

Figure 9. *The classification of the teaching material between studies*

### 3.3. The Repository Interface

The repository interface enables a user to specify the name and the description of the repository.



View all courses

**Fundamentals of Speech Communication** *University of Belgrade*

Edit course | Add repository

<b>Practice</b> The description of projects given to the student groups	28.02.2019	edit   delete
<b>Lectures</b> Description of the lectures: .... Teaching methods.pdf Celebration of learning.gif test.txt	15.12.2018	edit   delete
<b>Exercises</b> Description of the excersises: ... Learning process.pdf Learning.gif	15.12.2018	edit   delete

563.83KB  
33.12KB  
13.00B  
539.49KB  
86.49KB

Figure 10. *Classification of the teaching material between studies*

Repository is created if the user clicks the “ADD REPOSITORY” button. Changes are cancelled if the user clicks the “Back” link. The newly created repository is added to the course material interface, as shown in Figure 10.

### 3.4. Requirements for Storage Space of the Courses

All required information on the selected courses and the required storage capacity are gathered for all HEIs.

Table 1. *Overview of gathered information on modernized courses*

	HEI BSc/MSc study programme:		
	Course title:	Enhanced (E) or new (N):	Max. required storage:
Course (#1):	Course #1 title	E / N	... GB
Course (#2):	Course #2 title	E / N	... GB
Course (#3):	Course #3 title	E / N	... GB
Course (#4):	Course #4 title	E / N	... GB
Course (#5):	Course #5 title	E / N	... GB



Approx. planned: 2-10 enhanced and 1-4 new courses for BSc, and a little less for MSc



Approx. required space: 100 MB - 10 GB per course

After completion of the study programmes modernization, the web portal will be updated with new programmes, and the delivery of modernized study programmes will be initiated.

## 4. Overview of Collected Teaching Materials

The collected teaching material is classified according to the type of the study programme (MSc and BSc) across the knowledge areas (Communication Networks, Communication Systems, Information and Data Management, Information Theory etc...), as well as other training materials (such as webinars). So far, the teaching material has been collected for 12 courses on the master level and for 23 courses on the bachelor level, with the course lists being available in Figure 11a and Figure 11b respectively. Additionally, three webinars have been uploaded covering common topics in telecommunications study programmes.

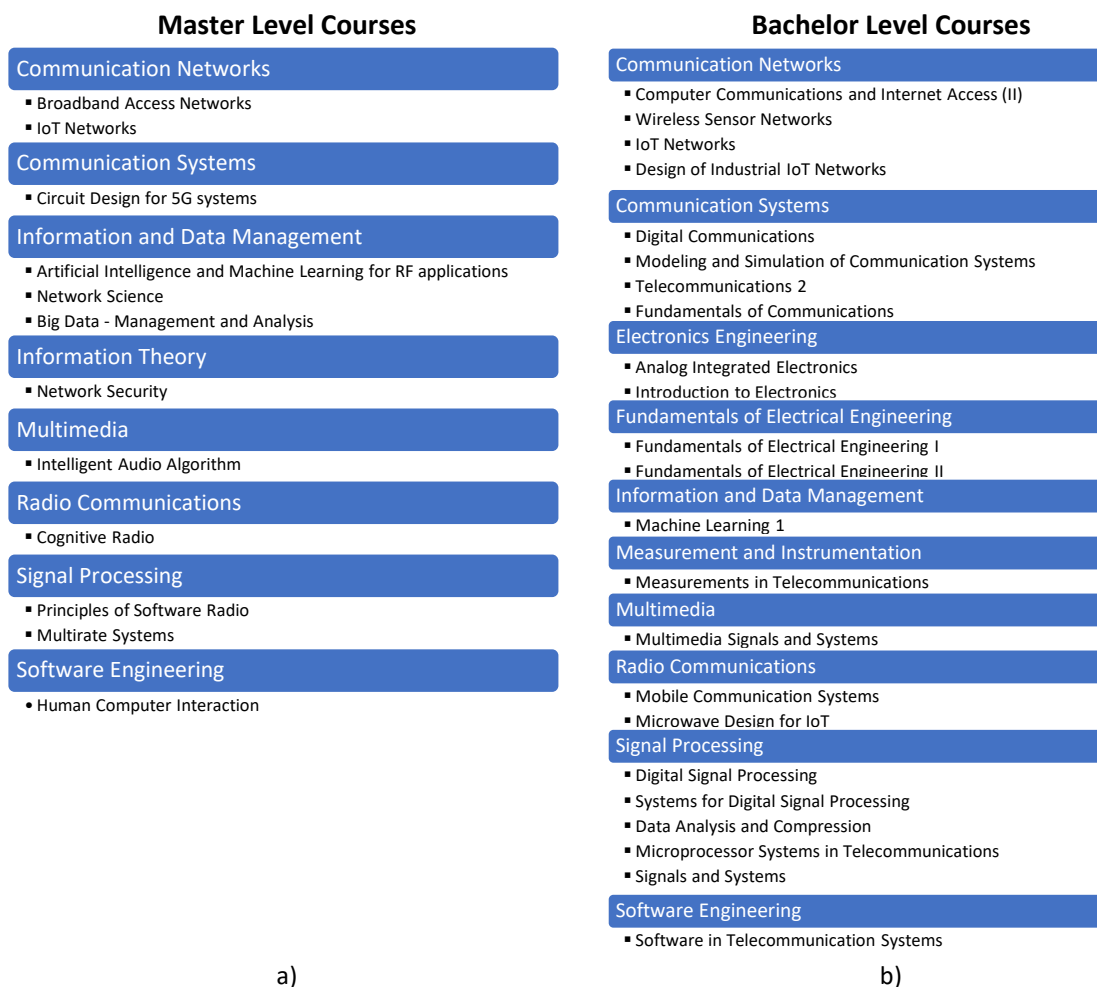


Figure 11. List of courses for which the teaching materials have been uploaded,

a) master level courses, b) bachelor level courses

As shown in Figure 12, browsing of the teaching materials is available by several categories: study programme (1) or other training materials (2), knowledge area (3) and course (4). The teaching materials are collected in the form of (password protected) course repositories, which enable easy categorization of the teaching materials (Figure 13). For each course repository a list of files is available with their respective file sizes.



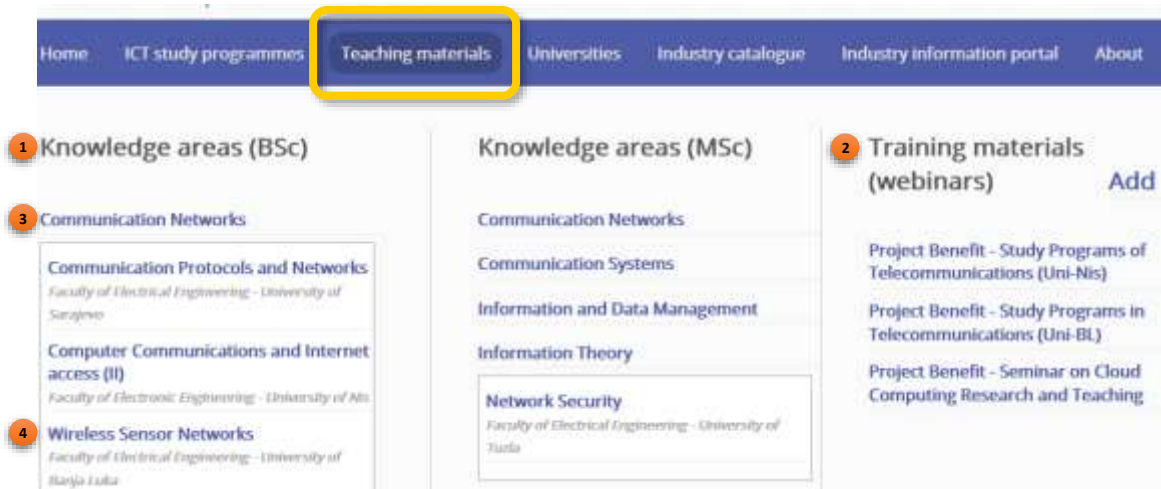


Figure 12. Teaching materials web repository browsing categories



Figure 13. Example course repositories within the course administration panel

Each course repository is fully editable, an example of which is given in Figure 14. The course repository parameters, such as its title and description, can be changed. The files within a course repository can be added or removed. This is done by a simple *drag&drop* action, or by manually selecting the files to upload using the “Add Files” button. Maximum size per file has been limited to 500 MB in order to prevent overutilization of the storage space, and to restrict teachers to split their teaching materials into smaller chunks, making the materials more organisable and less monolithic.



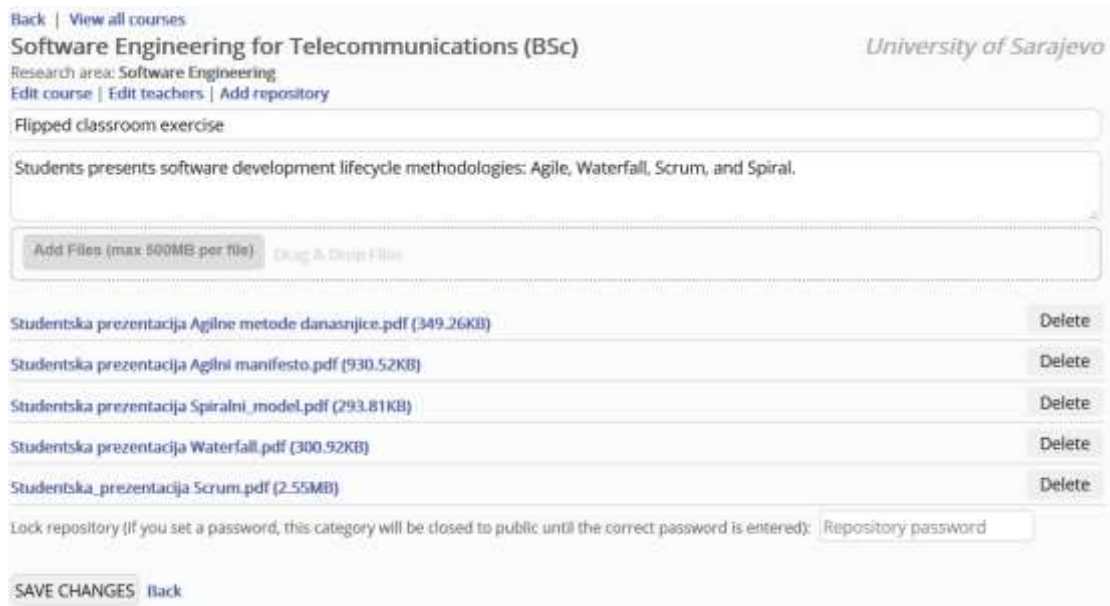


Figure 14. *Interface for editing a course repository*

A total of 104 course repositories have been created with 352 documents uploaded. The total size of the repository is 2466.58 MB with the average storage taken per course of 63.25 MB. The detailed Teaching Materials statistics is given in Table 2.

Table 2. *The Teaching Materials statistics*

<b>No. of course repositories</b>	104
<b>No. of uploaded files</b>	352
<b>Average files per course</b>	10
<b>Total size of the repository</b>	2466.58 MB
<b>Average storage occupied per course</b>	63.25 MB

The structure of the uploaded documents is given in Tab. 3: there were 231 PDF files uploaded, 20 video files (MP4), 9 audio files (WAV), 15 ZIP files, 65 presentations (PPTX) and 3 MS Word documents.

Table 2. *The structure of the uploaded teaching materials per file types*

<b>File type</b>	<b>No. of uploaded files</b>
<b>pdf</b>	231
<b>mp4</b>	20
<b>wav</b>	9
<b>zip</b>	15
<b>pptx</b>	65
<b>docx</b>	3

## 5. Conclusions

As described in the deliverable, the teaching materials are accessible in electronic format on the project's web repository for class material and remote classes (the web repository is described in more detail in D3.4). These teaching materials are enrichments to the modernized courses selected by the WP2. This deliverable is highly interconnected with WP2, which initially provided input on the selected courses to be modernised by the adoption of both new teaching methodologies and modern equipment. After having described the technical specifications of the web repository such as its interface and the technical requirements for storage of teaching materials, we made a list of the collected teaching materials.

This deliverable highly impacts the main project goals such as the modernization of teaching methodologies and the overall increase of attractiveness of ICT studies through the development of shared material via the e-platform.

## 6. References

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