

**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

**Editors:** A. Tonello, M. Zajc, D. Žagar, N. Suljanović, V. Delić

**Contributors:** V. Delić, V. Križanović, Z. Krpić, D. Došen, A. Mujčić, N. Jakovljević

**Disclaimer:**

"The European Commission support for the production of this publication does not constitute an endorsement of the contents which reflects the views only of the authors, and the Commission cannot be held responsible for any use which may be made of the information contained therein."

Deliverable data	Work Package and Outcome ref.nr	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, 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			

**Table of Contents**

1. Introduction.....	5
2. Objectives of the Deliverable .....	6
3. Teaching Material Web Repository .....	6
3.1. The course materials interface.....	9
3.2. Teaching material upload interface .....	11
3.3. The repository interface .....	13
3.4. Requirements for storage space the courses.....	14
4. Overview of Collected Teaching Materials.....	15
5. Conclusions.....	18
6. References.....	19

## 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 Fig. 1.



Figure 1. *D3.3 among other WP3 deliverables, relations 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 novel teaching methodologies (described in D3.1) and 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 novel learning/teaching methods.
- G2:** Upgrade the lab infrastructure through the development of novel thematic joint industry-academia labs.
- G3:** Increase the attractiveness of ICT studies through the development of joint e-platform.

The report describes the teaching materials, which is 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 project BENEFIT.

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

## 2. Objectives of the Deliverable

The main objectives of the deliverable are to adopt novel 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 provide them available as a web service. Apart from novel learning/teaching methods selected from available literature, the project BENEFIT has been 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 that is innovative at 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 a part of the main Central web platform (Fig. 2), the Teaching material web repository is available at: <https://www.project-benefit.eu/eplatform/?materials#5>



Figure 2. The link to the Teaching material web repository

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

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

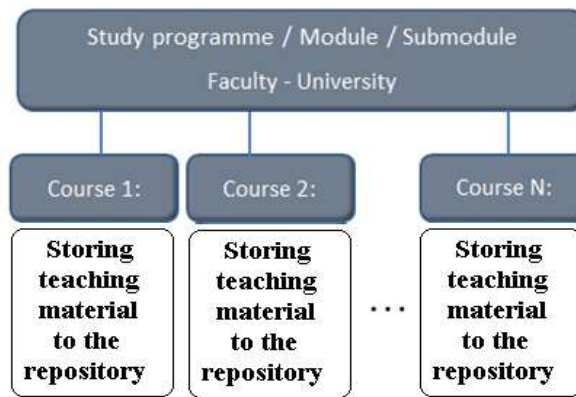


Figure 3. *The structure of class material storing within the Web repository*

To facilitate accessibility and promote internationalization, the collected teaching material could 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 on Fig. 3, Fig. 4, and Fig. 5. By selecting the appropriate study programme all the courses within it are listed.

For the 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)' and contains a list of 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)' and contains one item:
 

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

Red circles highlight the 'Teaching materials (BSc)' and 'Teaching materials (MSc)' headers. Red arrows point from these headers towards a yellow box labeled 'Study programmes' located between the two columns. The footer includes the Erasmus+ logo, project information, and a link to the administration page.

Figure 4. *The classification of the teaching material according to the type of study programmes*

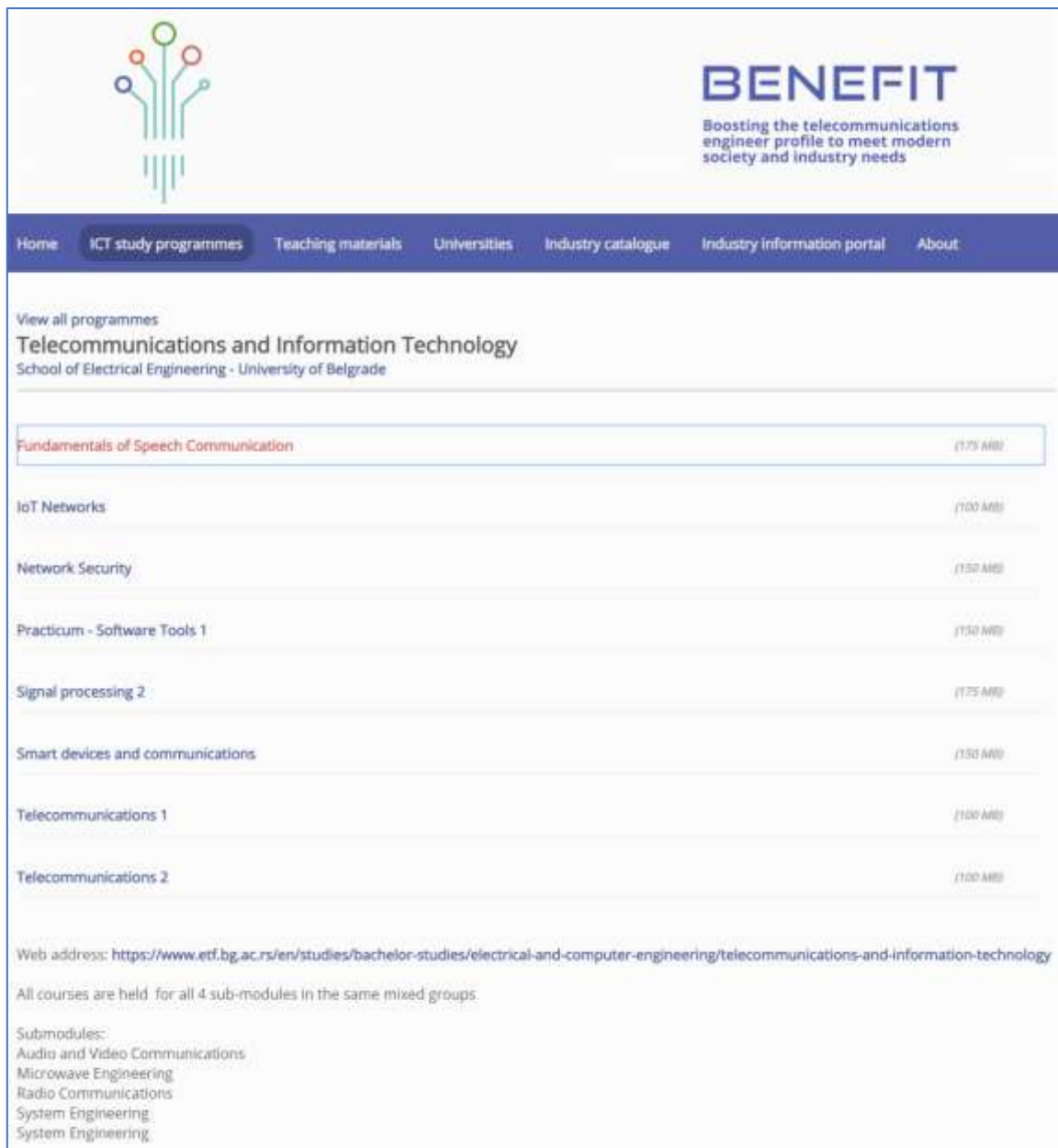
Within this list:

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

are presented.

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





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

Below the navigation bar, the page title is "Telecommunications and Information Technology" from the School of Electrical Engineering - University of Belgrade. A link "View all programmes" is present.

The main content is a table listing courses with their respective credit values:

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. The course materials interface

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

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

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

- Lectures,
- Exercises,
- Practice,

although arbitrary names are allowed so that the need for specialized content can be satisfied.

The screenshot displays 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 shows the course "Fundamentals of Speech Communication" from the University of Belgrade. There are two repository sections:

- Lectures** (dated 15.12.2018):
  - Description of the lectures: ... (563.83KB)
  - Teaching methods.pdf (33.12KB)
  - Celebration of learning.gif
- Exercises** (dated 15.12.2018):
  - Description of the exercises: ... (529.49KB)
  - Learning process.pdf (80.49KB)
  - Learning.gif

Below the repositories is a "Course description" section with a link to [https://www.ef.zg.ac.rs/en/ris/karton\\_predmeta/13E933OGK](https://www.ef.zg.ac.rs/en/ris/karton_predmeta/13E933OGK).

The footer includes the Erasmus+ logo, the text "Co-funded by the Erasmus+ Programme of the European Union", the website URL <http://benefit.ferit.hr>, and the project information: "Erasmus+ Project BENEFIT: 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP". There is also a link for "[Administration]".

Figure 6. *The overview of the web repository space for teaching material*

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

The screenshot displays 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 this is a navigation menu with links: Home, ICT study programmes, Teaching materials, Universities, Industry catalogue, Industry information portal, and About. The main content area shows the course "Fundamentals of Speech Communication" from the University of Belgrade. It includes options to "View all courses", "Edit course", and "Add repository". There are two main sections: "Lectures" and "Exercises". Each section lists files with their sizes and dates. The "Lectures" section includes "Description of the lectures: ...", "Teaching methods.pdf" (563.83KB), and "Celebration of learning.gif" (33.12KB). The "Exercises" section includes "Description of the excersises: ...", "Learning process.pdf" (539.49KB), and "Learning.gif" (86.49KB). Below these sections is a "Course description" link and 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 European Union and text: "Co-funded by the Erasmus+ Programme of the European Union". There is also a "Web:" section with "Project information: <http://benefit.ferit.hr>" and "Erasmus+ Project BENEFIT, 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP". On the right side, there are links for "[Accounts]" and "[Logout]".

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

If an user clicks on “delete” a dialog box appears for confirmation of deleting a repository. By clicking on “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 Fig. 8.

The “Add Files” dialog box enables uploading the files by dragging to the “Drag and Drop Files” area (point 1 in Fig. 8), or by clicking the button “Add Files” and browsing/selecting them locally. When uploading a file, the interface enables the classification of the files according to the classification (lectures, exercises, practice) and adding the short description of the uploaded file. During the file upload a brief progress bar shows up below the “Add Files” button (point 2 in Fig. 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'. Below this is a navigation bar with links: 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 includes options to 'View all courses', 'Edit course', and 'Add repository'. A 'Lectures' section contains a description field and an 'Add Files (max 500MB per file)' button. Below this, two files are listed: 'Teaching methods.pdf (563,83KB)' and 'Celebration of learning.gif (33,12KB)'. A 'SAVE CHANGES' button and a 'Back' link are also present. A 'Course description' section contains a URL. At the bottom, there is a footer with the Erasmus+ logo and project information. Two red boxes with orange circles labeled '1' and '2' highlight the 'Add Files' dialog box and the file list, respectively.

Figure 8. The 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 on each of them the user can download or open the files. There is an additional button “Delete” on the right of each of the file that enables deleting of the materials. For deletion a confirmation dialog box appears, so that the user cannot delete the file unintentionally.

Finally, when an 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 on Fig. 13. also has the “Add repository” link that opens an interface shown on 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)

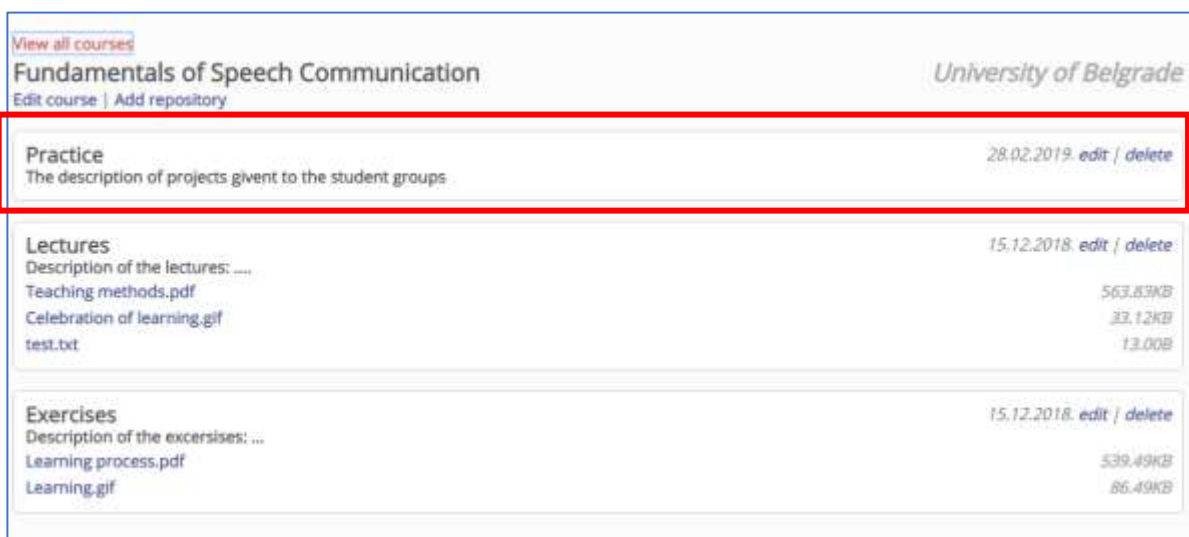
 Co-funded by the Erasmus+ Programme of the European Union  
Web: <https://www.project-benefit.eu/eplatform/>  
Project information: <https://www.project-benefit.eu>  
Erasmus+ Project BENEFIT, 585716-EPP-1-2017-1-AT-EPPKA2-CBHE-JP

[Accounts] [Logout]

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

### 3.3. The repository interface

The repository interface enables an 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 563.83KB 33.12KB 13.00B
<b>Exercises</b> Description of the excersises: ... Learning process.pdf Learning.gif	15.12.2018	edit   delete 539.49KB 86.49KB

Figure 10. *The classification of the teaching material between studies*

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

### 3.4. Requirements for storage space the courses

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

Table 1. Overview of gathered information about modernized courses

	HEI BSc/MSc study programme:		
	Course title:	Enhanced (E) or novel (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 novel courses for BSc, and a bit less for MSc



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

After completion of 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.

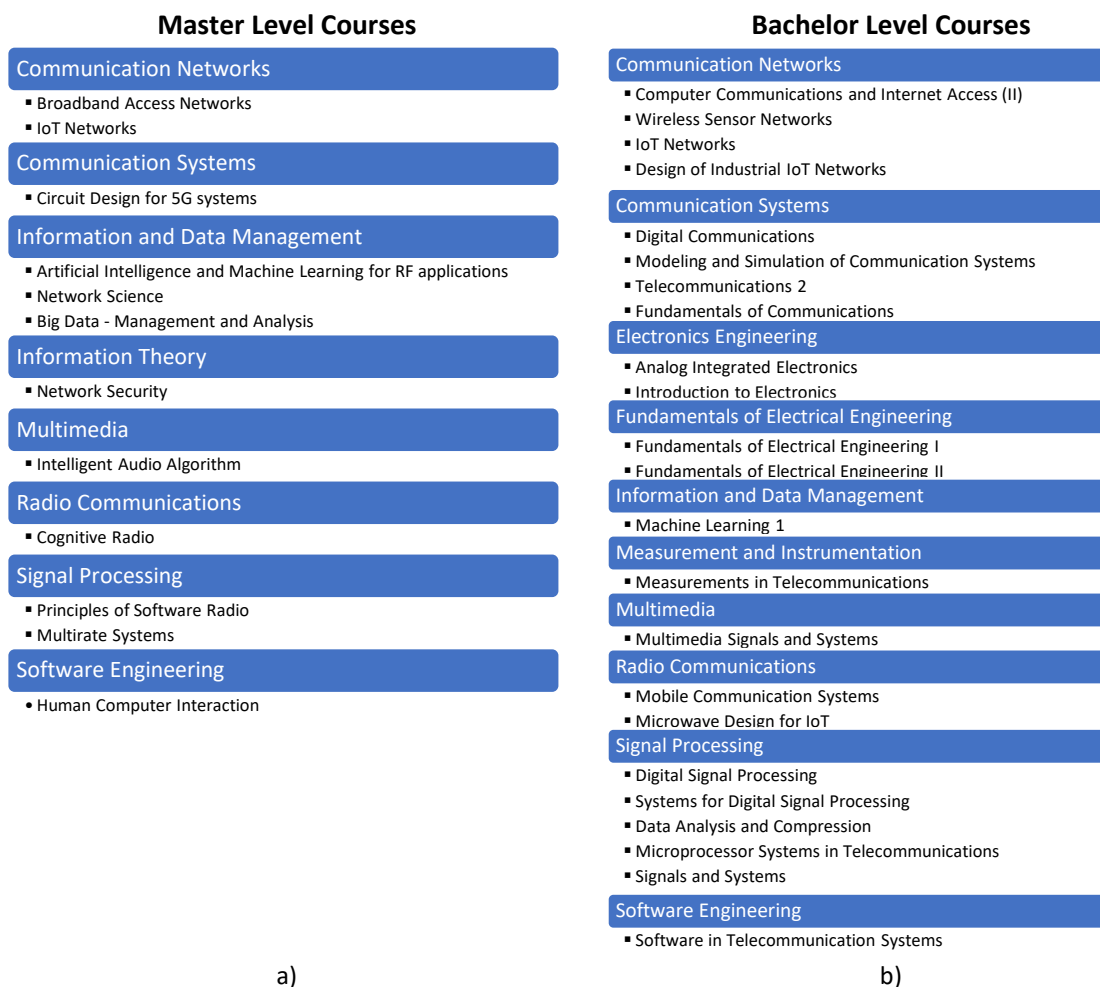


Figure 11. The list of courses for which the teaching materials have been uploaded,

a) master level courses, b) bachelor level courses

As shown on 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.

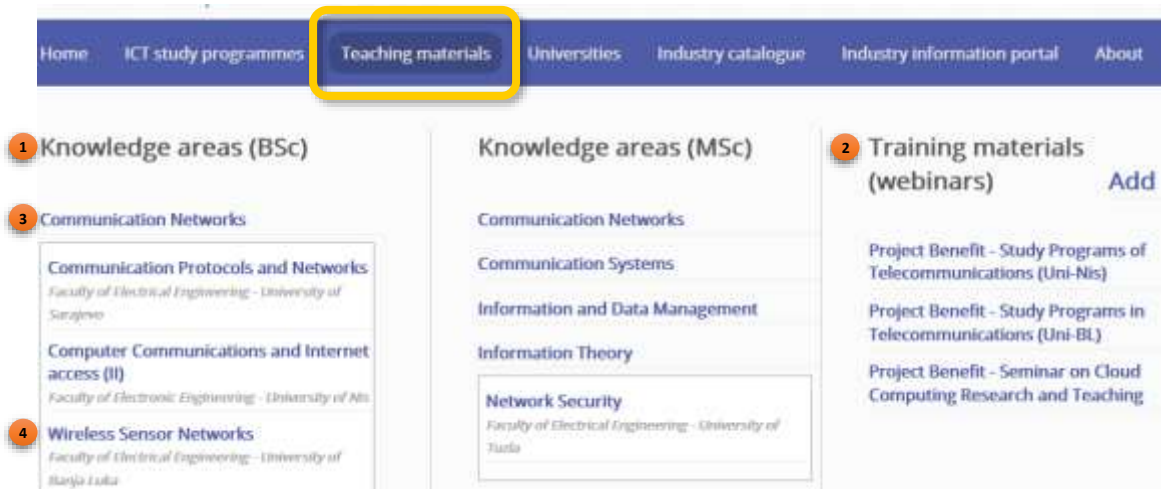


Figure 12. Teaching materials Web Repository browsing categories



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 organizable and less monolithic.



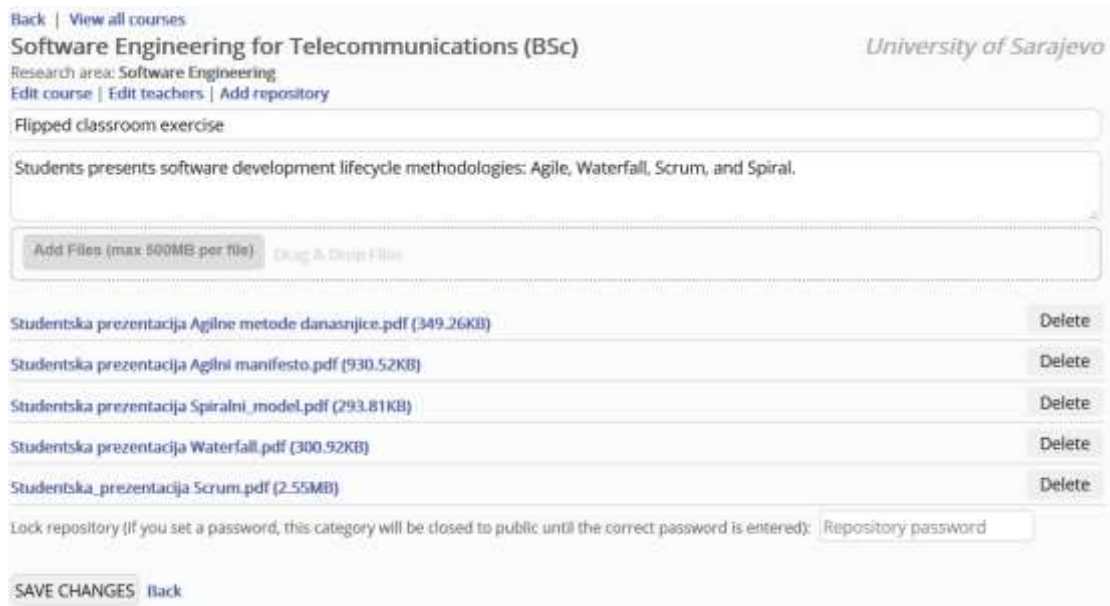


Figure 14. An interface for editing a course repository

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 Tab. 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 form 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 WP2. This deliverable is highly interconnected with WP2, which initially provided the input about the selected courses to be modernised by the adoption of both novel 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 elencanted 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

- Vlado Delić, Dejan Vukobratović, Milan Sečujski, Milan Narandžić, Živko Bojović, Tatjana Lončar-Turukalo, Dragana Bajović, Nikša Jakovljević, Vojin Šenk (2019) „Unapređenje profila inženjera telekomunikacija u skladu s potrebama savremenog društva i industrije“, XXV skup trendovi razvoja “Kvalitet visokog obrazovanja” - TREND 2019, Kopaonik, Srbija, 11-14.02.2019., ISBN: 978-86-6022-157-7, pp. 147-150
- Vlado Delić, Dragiša Mišković, Siniša Suzić, Tijana Delić, Branislav Popović, Nikša Jakovljević, Milan Sečujski (2019) „Centralna audio-biblioteka Univerziteta u Novom Sadu“, XXV skup trendovi razvoja “Kvalitet visokog obrazovanja” - TREND 2019, Kopaonik, Srbija, 11-14.02.2019., ISBN: 978-86-6022-157-7, pp. 36-39
- Vlado Delić, Dragiša Mišković, Branislav Popović, Milan Sečujski, Siniša Suzić, Tijana Delić, Nikša Jakovljević (2019) “Central Audio-Library of the University of Novi Sad”, Intelligent Human-Machine Interfaces, 13th International Symposium on Intelligent Distributed Computing, 7-9.10.2019, Saint-Petersburg, Russia, I. Kotenko et al. (Eds.): IDC 2019, SCI 868, Springer, pp. 467-476, DOI: 10.1007/978-3-030-32258-8\_55