2021

REPORT WP1 DEV 1.1

WP1 STATE OF THE ART ON MARITIME ENVIRONMENTAL PROTECTION AND MANAGEMENT

DEV 1.1 Overview of MSc programs in field of MEP&M at EU HEIs

DEVELOPMENT OF REGIONAL JOINT MASTER PROGRAM IN MARITIME ENVIRONMENTAL PROTECTION AND MANAGEMENT
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Development of Regional Joint Master Program in Maritime Environmental Protection and Management – MEP&M
Project no. 619239-EPP-1-2020-1-ME-EPPKA2-CBHE-JP

REPORT ON OVERVIEW OF MSC PROGRAMS IN FIELD OF MEP&M AT EU HEIs

Overview of MSc programs in field of MEP&M at EU HEIs

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Contents

List of abbreviations and acronyms

MEP&M	- Maritime Environmental Protection and Management
UoM	- University of Montenegro
UAMD	- Aleksander Moisiu University of Durres
UV	- University 'Ismail Qemali' Vlore
UL	- University of Ljubljana
UCA_F	- Université Côte d'Azur
UCA_E	- University of Cadiz
GMD	- General Maritime Directorate
EPA	- Environmental Protection Agency
ECD	- Ecological Center DOLPHIN

1. Introduction

Author(s) of Introduction: Srdjan Redzepagic, Université Côte d'Azur (France)

Blue economy sector in Montenegro and Albania is marked as most influential on local and regional source of marine pollution as well as contributor to the global climate changes. The latest European Commission's 2019 Annual economic report on Blue economy included economic activities that are: marine-based, including those undertaken in the ocean, sea and coastal areas, such as capture fisheries and aquaculture, offshore oil and gas, offshore wind energy, ocean energy, desalination, shipping and marine transport, and marine and coastal tourism; and marine-related activities which use products and/or produce products and services for the ocean and marine-based activities. The Blue economy also includes those parts of the public sector with direct coastal and ocean responsibilities (national defense, the coast guard, marine environmental protection, etc.), as well as marine education and research.

As stated in the application form of the Erasmus + CBHE project Development of Regional Joint Master Program in Maritime Environmental Protection and Management - MEP&M, Montenegro and Albania are desperately seeking for those professionals with knowledge, experience and skills in the field of marine environmental protection who will be able to manage environmental issues and help in achieving national and regional environmental goals. From this urgency arose a main goal of the project which is development of regional joint interdisciplinary MSc program on English in the field of Maritime Environmental Protection and Management.

Université Côte d'Azur from Nice in France is a lead partner of MEP&M WP1 *State of the art on maritime environmental protection and management*, which is divided into 3 deliverables - each delivering report as an outcome.

This Report represents the initial step in the achievement previously mentioned goal, representing an outcome of WP1 DEV 1.1 *Overview of MSc programs in field of MEP&M at EU HEIs*.

Report DEV 1.1 gives an overview of state of the art of master programs in the broader field of Maritime Environmental Protection and Management at EU partner HEIs, as well as state of the art of e-learning methodology and technology implemented at their universities in period before and during COVID 19 pandemic.

Partner institutions from EU represented in this report include the Université Côte d'Azur from Nice in France, University of Cadiz from Cadiz in Spain, and University of Ljubljana from Ljubljana in Slovenia.

2. New challenges faced by the European Higher Education Area during and after COVID 19 pandemic

Author(s) of the Chapter #2: Javier Izquierdo Antón, University of Cádiz (Spain)

Since the beginning of the COVID 19 pandemic crisis, European universities have encountered a lot of problems related to the way they develop their educational programs and activities related to management and research. We were not prepared for such an abrupt change in the context in which we carry out our activities. But this change of context has highlighted the need to rethink and reorganize the way we offer, develop and evaluate the education we provide.

The first question we can ask ourselves is: Is face-to-face attendance necessary in our educational programs? The answers are many, depending on which program and circumstances we focus on. For example, medical teaching-learning and training programs are not the same as law or engineering programs. It is clear that face-to-face attendance is necessary in many cases, but not in all the teaching and learning activities that take place. This leads us to consider the advantages of reducing and adjusting face-to-face attendance. Advantages in terms of saving time, fuel, necessary space, group organization, among many others. In addition, it is possible to think of activities that are developed according to the needs of each student. It is not necessary to synchronize all the actors in the teaching-learning process, making it feasible for students to follow processes adapted to their circumstances and to do so dynamically.

Taking all this into account, it is possible to begin to point out the challenges we face and which we indicate below:

- Teacher training. A blended or virtual environment and development, entails an instructional design adapted to these new needs. Putting into practice and offering these teaching-learning and training programs requires teaching staff capable of commanding the change.
- Development of virtual teaching-learning-training environments adaptable in real-time. Current virtual learning environments are not as flexible as they need to be. These environments need to be developed so that teaching is enhanced and training is appropriate for each subject/program being developed.
- Basic means available. Universities must have means capable of providing sufficient bandwidth and interaction to the programs offered.
- Student means. Students must have the necessary computer resources to access all the resources that will be made available. This reality should not lead to discrimination and the segmentation of opportunities. Finding ways to provide support requires offering funding programs for underprivileged students.
- Internationalization. Internationalization is a key factor in university education today. Taking courses at other universities and in other languages should be a standard part of university education and training curricula. Making this possible in a face-to-face,

blended or virtual format is a challenge. In addition to this challenge, the bureaucratic framework must be significantly reduced and made more flexible.

- Additional activities in the social environment. University training needs real activities within the social environments where teaching takes place. Activities that help a quick labour integration of the future professional. It is a challenge to integrate real activities within the university programs offered from now on.

3. Overview of MSc programs in the field of MEP&M at the Université Côte d'Azur, Nice, France – Educational framework and institutional practices

Author(s) of the Chapter #3: Christophe Mocquet, Université Côte d'Azur (France)

3.1 Master's degree programs related to MEP&M topics at Université Côte d'Azur

Within the MARRES Research Institute, the research units are composed of researchers/teachers involved in the "marine resources" training of the Université Côte d'Azur, in this case at Master level. The inclusion of the masters within the IFR MARRES and its academic and socio-economic network opens students to employability in all sectors of blue growth. A real educational ecosystem is created: professional opportunities and exchanges are favoured with a proximity between students and researchers in the scientific world.

Courses most closely related to MEP&M are:

- The **MSc MARRES "Marine Resource Science, Conservation & Innovation"** is a multidisciplinary master's degree aimed at training students in the responsible valorization of marine resources while integrating the socio-economic dimension. The training of students to face current and emerging challenges related to the oceans is done through a multidisciplinary education combining science and society.
- The **Master "Law of the Sea and Maritime Activities"** (DMAM) is a professional Master course within the framework of the Master "International and European Law". The teaching offer (mostly in French) enables students to acquire a complete legal culture in the law of the sea and maritime activities.

Tthe members of the IFR units are also involved in more specialised training. They provide knowledge of the marine world that is applicable in other fields.

- The **MSc RISKS** is an international master's degree in risk management. Nice and its surroundings are subject to extreme climatic events that classify the region as a climate change hotspot (IPCC), which makes it an ideal place to study risk in all its forms, including ones related to the sea and marine activities.
- The **Master's degree in Life Sciences (SVS), Health track** is a clearly stated training programme "by and for research", the main objective of which is to train students to be able to work in the health sector. The main objective is to train students to work as researchers in the public or private sector.
- The objectives of **the F2C (Perfume and Fine Chemistry) master's degree** are to provide students with a thorough grounding, both theoretical and practical, in the field of Reactivity and Synthesis Strategies in Organic Chemistry, with a particular emphasis on the design, synthesis and characterisation of molecules of interest in the field of flavour and fragrance chemistry. It relates to the Blue Growth through the aspect of biotechnology, and the use of marine bioactive molecules in cosmetics

3.2 Master's Degree in Marine Resources Science, Conservation & Innovation - MARRES

In a world that is finally beginning to understand the importance of the ocean to our society, it is critical that scientific, economic and societal stakeholders work together. Science seeks to better understand the relationships between marine organisms and their environment, thus facilitating the protection of the ocean by highlighting its value to society. In parallel, our understanding of the marine environment opens up new economic opportunities in the fields of aquaculture, pharmaceuticals, cosmeceuticals, tourism, construction and energy.

In its main track **Science & Society**, the MSc in Marine Resources Science, Conservation & Innovation prepares students to pursue a Ph.D., as a prelude to their future research career. They will also be able to develop conservation projects locally or internationally. Students will have the foundations to enter the private sector, where they will be able to model the marine environment, become project managers or auditors in environmental consulting firms. Finally, they can become entrepreneurs by developing the countless marine resources that they will help to protect.

With a limited life science background, students may be interested by our **Level-Up certification** before applying to the Science & Society track. And for professionals and for graduates from other fields who would like to redirect their career, we have designed the 1-year track **Blue Managers**.

A large part of the MARRES program instructors are professors and researchers at Université Côte d'Azur, within the Marine Resource Research Institute, which brings together all the teams working on the sea at UCA_F (ecology, biology, chemistry, law and economics), as well as from other French and international universities. Numerous experts from the private sector complement this academic experience, particularly in the socio-economic fields of conservation, innovation and entrepreneurship.

3.2.1 Science & Society track

3.2.1.1 The objective

Our 2-year interdisciplinary approach, combined with empowering **immersion projects**, allows student to become researchers, conservation specialists, environmental consultant, or entrepreneurs. Whatever their interests, they will become the open-minded specialist that our society needs to solve current and emerging ocean issues

To get there, students have to:

- acquire high-level scientific knowledge, develop critical thinking and adopt the scientific approach in all circumstances
- assess the current and emerging ocean-related challenges, and their possible solutions according to the socio-economic context
- contribute to wised decision-making, through environmental quality and impact analysis, and by adapting communication to a targeted audience

- develop entrepreneurship skills & recognize and combine scientific, economic and social potential of marine resources

3.2.1.2 The program

The "Science & Society" track offers an innovative and interdisciplinary way to understanding the interdependencies between scientific, societal and economic aspects of the ocean.

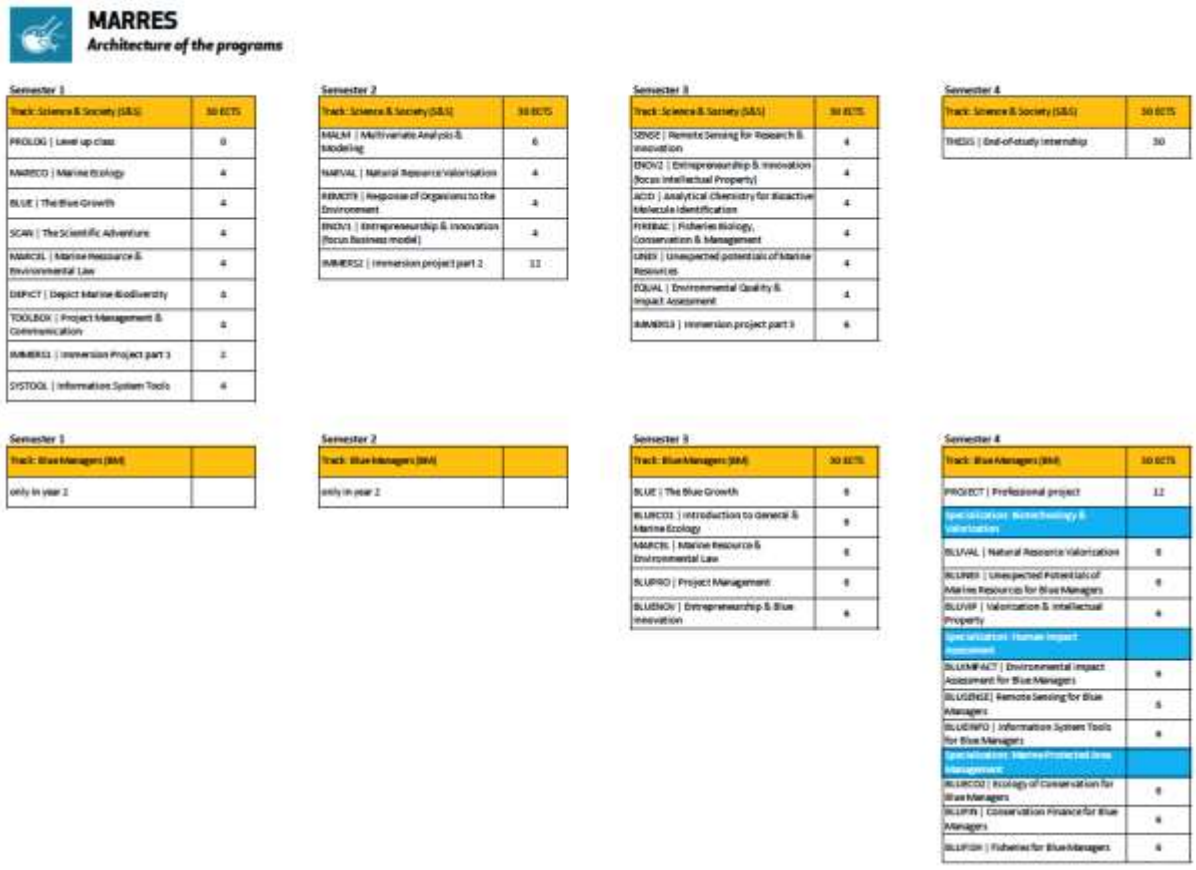
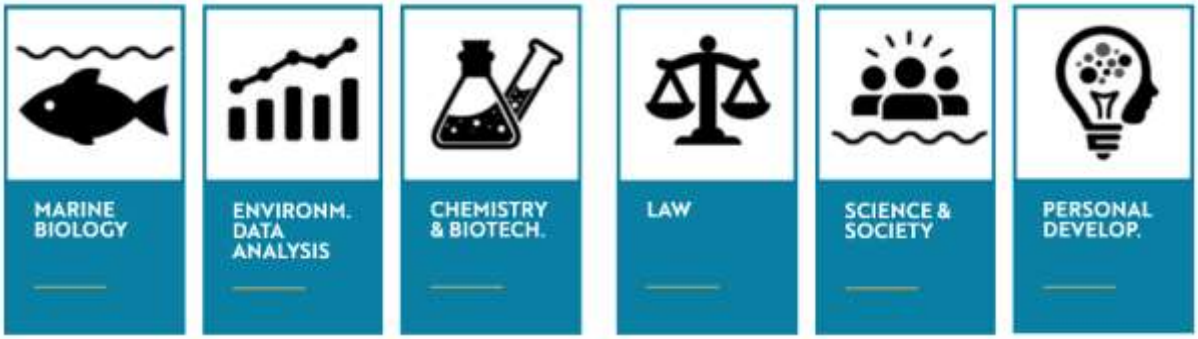


Figure 3.1 Courses within MSc in Nautical Science and Maritime Transport. Source: https://univ-cotedazur.eu/msc/marres/program



3.2.1.3 The Immersion projects program

Objective: GET STUDENTS INVOLVED IN THE PROFESSIONAL WORLD FROM THE START

Together with professionals of the public and private sectors, we have developed plurennial projects with high-scale objectives. In the track "Science & Society", students develop these projects over multiple years from cohort to cohort. This long-term approach allows students to get prepared for their 1st-year internship beforehand, and upon completion, to use extra-time to value their work and coach those who will take over.

This experience connects the students together and with local and international professionals in science, conservation and/or entrepreneurship according to their career objectives. In short, the immersion projects encompass the 1st-year internships, but it's much more than that!

Schedule of the immersion projects:

1. **Warm up phase**: from semester 1, all Mondays are fully dedicated to preparing the Y1 internship with a coaching on project management and a peer-coaching from 2nd-year-students.
2. **Internship phase**: during 4 to 6 months Y1 students are 100% devoted to the project implementation thanks to preceding months of preparation.
3. **Polish-up & coach phase**: once in semester 3, Y2 students still benefit from all Mondays dedicated to completing their objectives and to teach the acquired skills & knowledge to the Y1 students who are taking over.
4. In 2nd year, students conduct their end-of-study internship of 6 months (thesis) on another subject to open their perspectives

The immersion project catalogue can be accessed here: https://univ-cotedazur.eu/msc/marres/immersion-projects/immersion-project-catalogue

3.2.1.4 Sum up

Figure 3.2 Sum up of MSc MARRES - Science & Society track Source: https://univ-cotedazur.eu/msc/marres/program

3.2.2 Blue Manager track

3.2.2.1 The objective

This one-year online training offers a unique learning opportunity in marine science and management to redirect a career to blue growth. It is open to English-speaking candidates with a professional experience of at least 3 years in the same field of activity and / or graduate of a master's level program in a scientific or non-scientific theme, wishing to reorient towards marine resources.

3.2.2.2 The program

The 1-year program starts in September and the class period ends in March. Then, students complete their professional project thanks to the skills and knowledge they have acquired. The teachings are online with a combination of video-capsules, practical activities and remote face-to-face. Most of the face-to-face take place in the French afternoons.

All the students will discover what is the Blue Growth, build a background in ecology and law of the Sea, improve their management skills, and develop their own professional project. Students are proposed three specializations:

- **Biotechnology & Valorization**: to join the Blue Economy to value (and protect) one of the unexpected potentials of marine resources from tourism to cosmetics & pharmaceutics.
- **Human Impact Assessment**: to learn how to quantify the impact of humans on marine ecosystems to join environmental management

- **Conservation Management**: to learn how to manage and protect a marine area by combining scientific and socio-economic perspective

Details on the program can be found here: https://univ-cotedazur.eu/msc/marres/track-blue-managers

3.2.2.3 Design a new professional project

In order to design a (new) career in blue growth, students are accompanied by a coach specialized in the target field. The first semester allows to prepare the new project with a coach. Students should apply it in the second semester within the framework of an internship, a work placement, or a feasibility study for the creation of a new start-up.

3.2.2.4 Sum up

Figure 3.3 Sum up of MSc MARRES - Blue Manager track. Source: https://univ-cotedazur.eu/msc/marres/program

3.2.3 The level up certification

This training introduces fundamental notions in natural sciences. It is designed for talented students with at least an undergraduate diploma in a non-natural science discipline (such as in Economics, Management, Political Science, Law, Communication, Engineering) to apply to a graduate program such as the "Science & Society" track of the MSc. MARRES or simply to (re)discover biology, ecology, chemistry & oceanography. The program is fully online and asynchronous and can be started at any time, for a recommended period of 3 months.

Each discipline proposes a personalized learning path thanks to learning blocks combining video clips, interactive activities, checkpoints to test knowledge acquisition and assignments. Forums allow students to exchange together and a tutoring is provided by a member of the MARRES team.

The level-up training is a fully asynchronous program that can be taken at any time and at the pace chosen by the students. Students unlock the activities as they progress through the module. We recommend targeting the spring and early summer period to best prepare the "Science & Society" track

3.3 Master's degree in Law of the Sea and Maritime Activities - DMAM

The "Institut du Droit de la Paix et du Developpement" offers, within the framework of the master's degree "International Law and European Law", a professional master's degree specializing in the law of the sea and maritime activities (mostly in French).

The teaching offer enables students to acquire a complete legal culture in the law of the sea and maritime activities, which is particularly appreciated by professionals.

3.3.1 Aim of the MSc program DMAM

The degree aims to provide a high-level legal specialization in the field of the law of the sea and maritime activities, through the environmental prism of its applications in the marine environment and coastal development. The degree also has the particularity of making lawyers aware of scientific and technical issues, which are essential to their training as lawyers in the law of the sea.

3.3.2 Pre-requisites of the MSc program DMAM

This course is aimed at students of law, preferably with a master's degree specializing in international and/or European law, without being closed to other specialties. It is also open to political scientists and economists as well as to academics with a degree equivalent to a Master 1 and who can justify the prerequisites. The program is also open to students in continuing education. Admission is by selection based on a portfolio.

3.3.3 Courses of the MSc program DMAM

Next courses are taught at MSc program DMAM:

- Law of the Sea
- Marine environmental law
- Law of marine protected areas
- International and European maritime transport law

- Environmental regulation of maritime transport
- Social law of seafarers
- Marine science and sustainable development
- Marine biological and genetic resources law
- Law of energy and mineral resources
- International and European law on safety at sea
- State action at sea
- Law of coastal planning and protection
- Port law and yachting law
- Integrated coastal zone management
- Professional English

4. Overview of distance learning methodology and technology at the Université Côte d'Azur, Nice, France

Author(s) of the Chapter #4: Christophe Mocquet, Université Côte d'Azur (France)

4.1 Hybrid strategy of Université Côte d'Azur distance learning

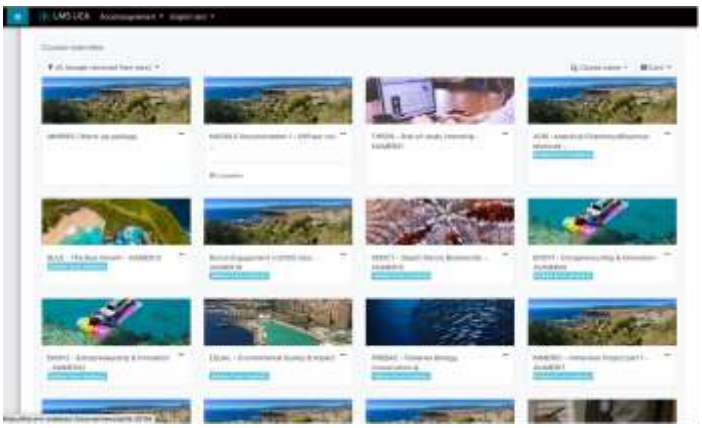
Our teaching modules are generally designed following a blended-learning approach articulated in learning blocks allowing students to prepare for their face-to-face interactions with instructors through prior asynchronous work.

- Learning blocks are composed of short video capsules, self-paced preparatory activities, and checkpoints for students to assess their learning progress.
- Face-to-face interactions are thus reinforced and enriched by constructive exchanges in the form of recitation, workshops, and discussions.

4.2 Online tools

Whether in the fully online Blue Managers track, or for the asynchronous parts in the Science & Society track, our interactive digital tools are used to optimize the student learning experience.

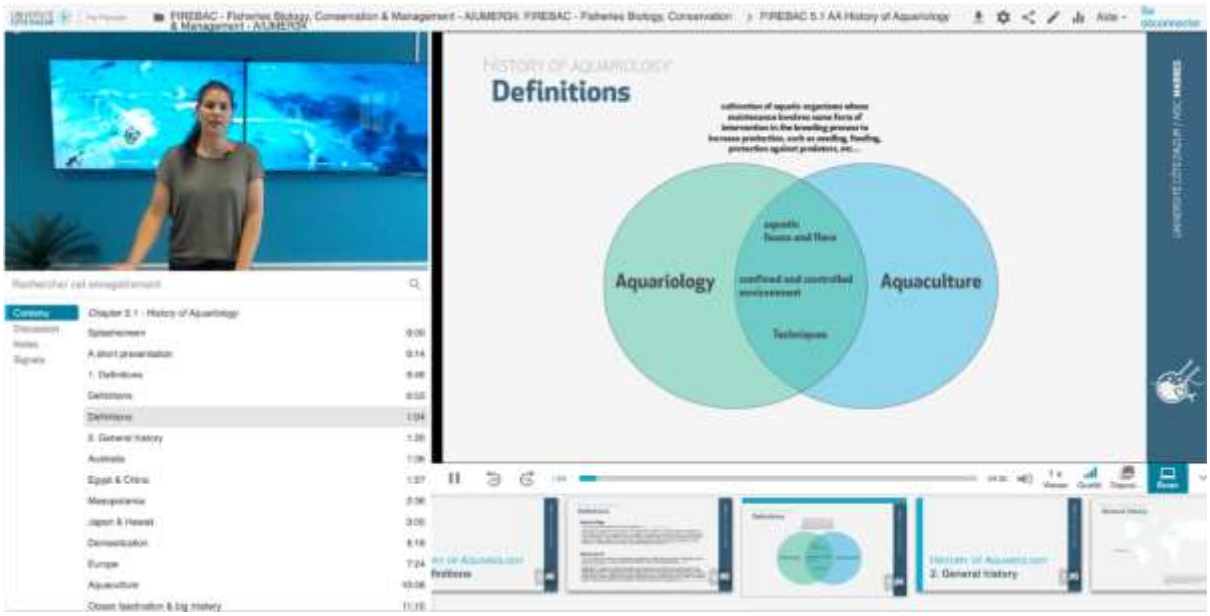
4.2.1 E-learning platform



Like many other international universities, we have chosen Moodle as our primary e-learning platform. All our courses are fully deployed on there: all course documents, activities, video conference links, workshops, exams, grades ... All our other digital tools are aggregated on Moodle.

4.2.2 Video capsules

Whether as a full-online student or also on-site, our video capsules are at the heart of the blended-learning approach of most MARRES modules. Lectures are usually taught via these short interactive videos, each corresponding to a key notion.
The Panopto platform allows students to navigate through these videos thanks to menus by slide, by topic, to search for key words, to adjust the size of the different windows, to take notes synchronized with the video, to engage in a discussion with the teacher and the students. Instructors can choose to directly insert external content such as videos and short quizzes.



4.2.3 Recitations

Before or after the video capsules, instructors can choose to test pre-knowledge or knowledge acquisition via a live exchange platform (on-site and online at the same time) using smartphones and tablets called Wooclap. For example, it can allow instructors to see which parts to review in priority during recitations (those face-to-face moments after a set of video capsules). It also allows to create polls, to let students ask questions during presentations... and we also use it during our "MARRES Game Night".

4.2.4 Face-to-face

The video capsules do not replace the teacher, at the opposite they allow to better prepare for face-to-face discussions. In the Science & Society track, these exchanges are done on-site as much as possible, but depending on local and international health conditions and on the needs of each participant, these exchanges can also take place via our video conferencing tools, mainly Zoom and BigBlueButton. This is the standard for the Blue Managers track.

4.2.5 Labs & Field trips

Field trips and labs are important moments in the students' learning path. For those who cannot join us on site for all these events, an online toolkit is available.

For example, the field trip to the Lérins Islands is partly digitized thanks to the Thinglink platform which allows students to immerse themselves in the archipelago. Aerial and submarine drone shots allow students to participate in the analysis of the results from a distance. We agree, nothing will replace being able to jump in the water, but we try to do our best.

5. Overview of MSc programs in the field of MEP&M at the University of Cadiz, Spain – Educational framework and institutional practices

Author(s) of the Chapter #5: Ana Macías Bedoya and Javier García Onetti, University of Cádiz (Spain)

5.1 Master's Degree in Integrated Coastal Zone Management (ICZM)

Next, are identified the master programs of the University of Cádiz (UCA_S) that include contents in the field of protection and management of the maritime environment. Also is included a summary of the general information about those master degrees.

5.1.1 Master's Degree in Integrated Coastal Zone Management (ICZM)

Name official university degree (in Spanish): Máster en Gestión Integrada de Áreas Litorales (GIAL).

The objective of the master is to provide society with experts capable of tackling the challenges currently facing the management of a territory as complex as the coastline. In particular:

1. The challenges posed by climate change: rise in sea level, increase in the frequency/intensity of storms, increase in erosion, etc.
2. The challenges posed by marine pollution and the vulnerability of the coast to the risks of pollution, etc.

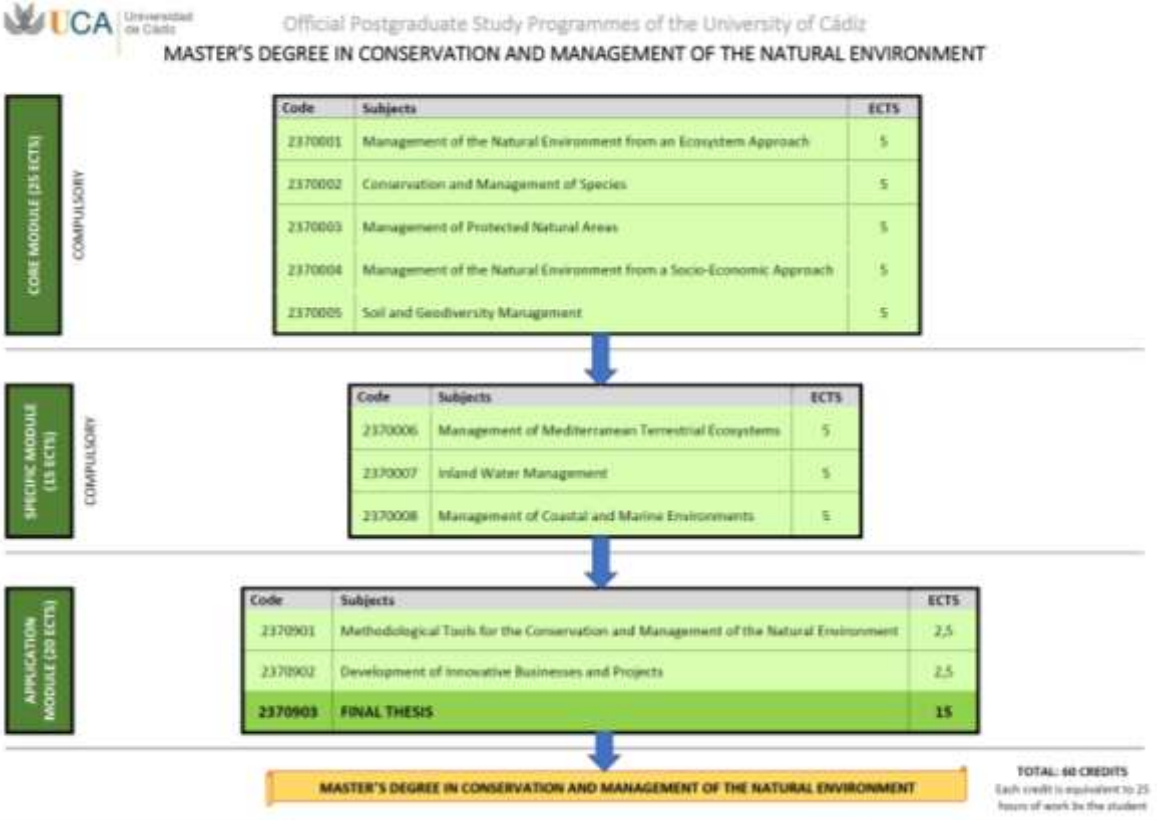


Figure 5.1 Courses within MSc in Integrated Coastal Zone Management (ICZM).

All this through the teaching of integrated management methodologies. It is interpreted the integrated management as an interdisciplinary management of the coastal zone, dealing with activities and groups involved to achieve coastal sustainability, and providing technical support for companies and public institutions through consulting and preparation of coastal management plans and projects.
In Figure 5.1 are given courses within Master's Degree in Integrated Coastal Zone Management (ICZM).

5.1.2 Master's Degree in Conservation and Management of Natural Environment

Name official university degree (in Spanish): Máster en Conservación y Gestión del Medio Natural.
This master has a remarkable practical orientation, applied to research in the field of conservation and management of the natural environment, and the management and environmental conservation in administrative levels and private companies. Objectives:

1. Advanced training of in the field of conservation of the natural environment, both terrestrial and marine.
2. Provide the competences and skills for the development of an integral knowledge-based management.

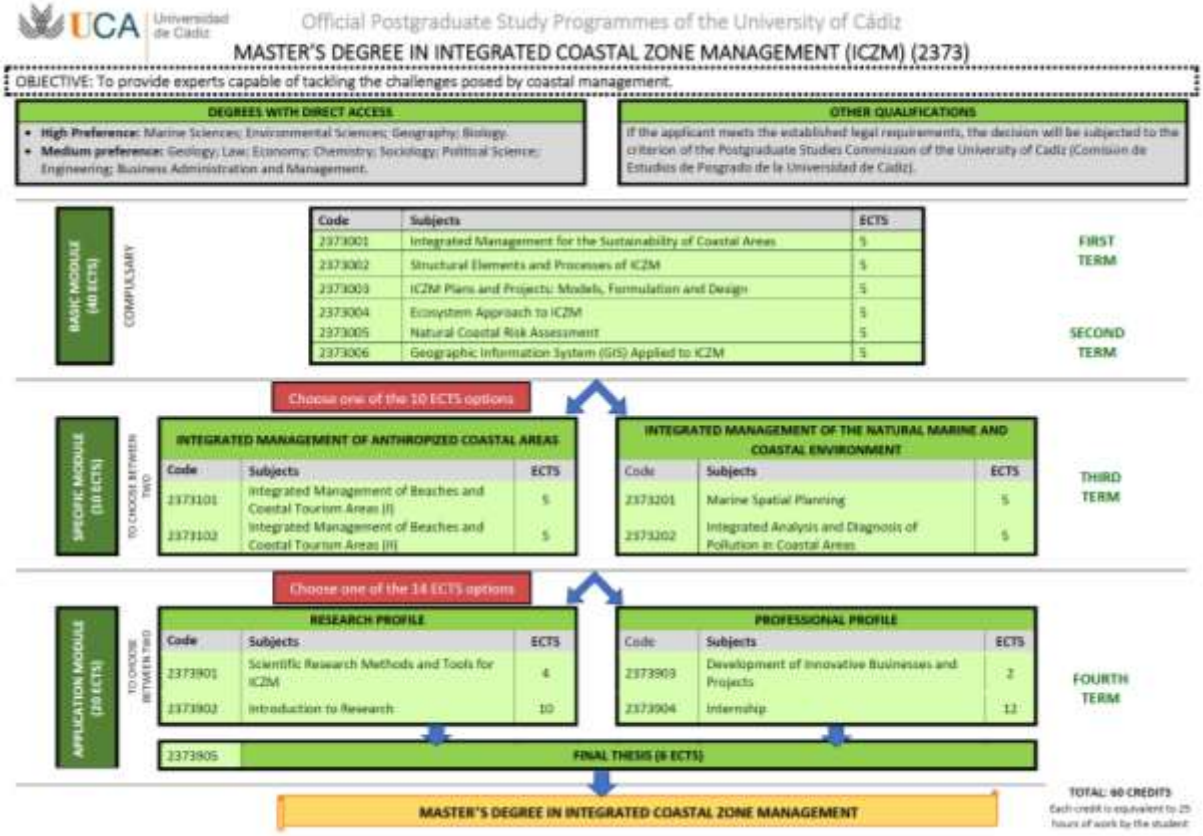


Figure 5.2 Courses within MSc in Conservation and Management of Natural Environment.

The MSc on Conservation and Management of the Natural Environment is designed to prepare graduates for a PhD program in order to begin a research career. However, the

training received in this MSc also enables students to develop a professional career in different fields:

1. Conservation and management of the natural environment and resources.
2. Development of activities of Conservation and Management of the Natural Environment based on knowledge in public or private entities.
3. Entrepreneurship activities in the field of Natural Environment Management.

In Figure 5.2 are given are given courses within Master's Degree in Conservation and Management of Natural Environment.

5.1.3 Master's Degree in Aquaculture and fisheries

Name official university degree (in Spanish): Máster en Acuicultura y Pesca.

The main objective of the master's degree in Aquaculture and Fisheries is to train researchers and higher technicians' specialists to be able to approach the study and management in aquaculture and fisheries in an integrated manner. The Master's Degree provides students a specialized view and training at the highest level in both, basic and applied knowledge in fundamental aspects such as the biology of marine species, fisheries, aquaculture, controlled production, environmental management, sustainability, legislation... The Master's Degree structure allows students to develop work in Centers, Institutions and Companies with different point of view in aquaculture and fishery scopes.

In Figure 5.3 are given are given courses within Master's Degree in Aquaculture and fisheries.

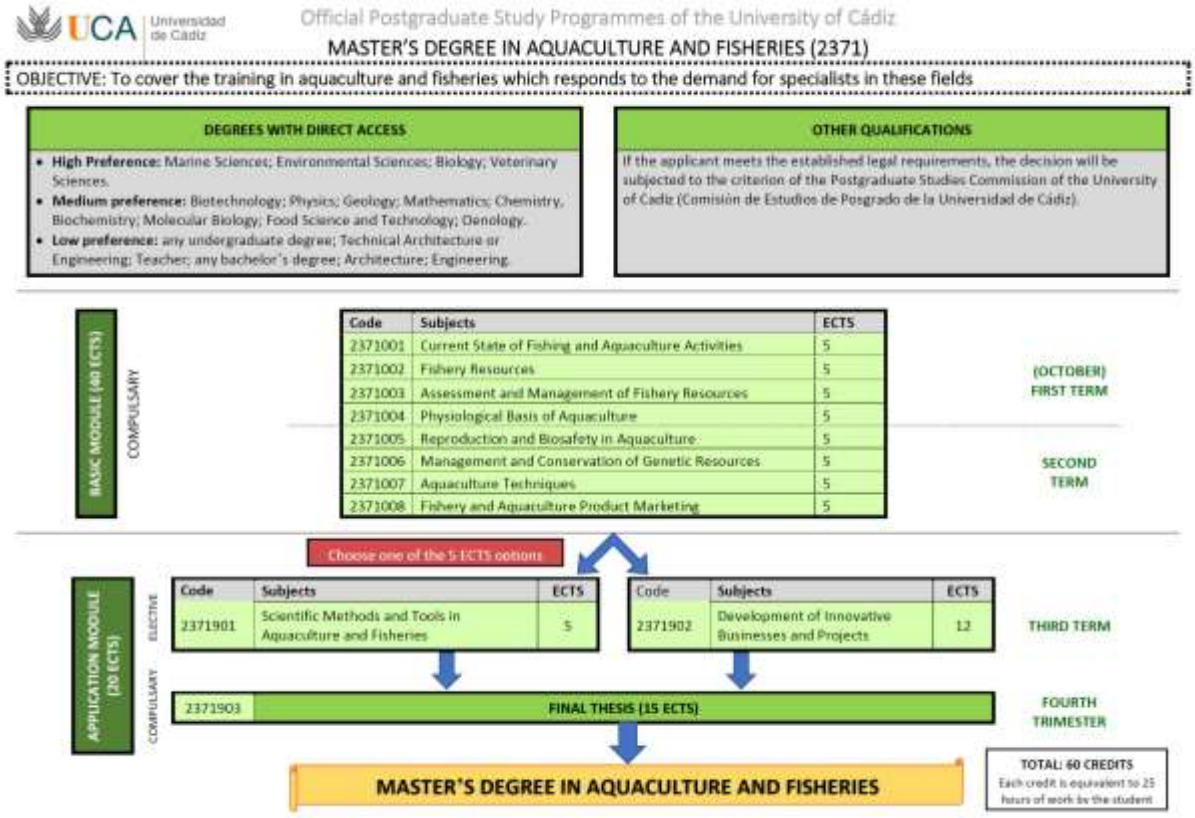


Figure 5.3 Courses within MSc in Aquaculture and fisheries.

5.1.4 Master's Degree in Nautical Science and Maritime Transport

Name official university degree (in Spanish): Máster en Transporte Marítimo.
His master's degree provides high-level skills in the knowledge areas linked to nautical engineering and maritime transport: the structure and behavior of ships at sea, maritime transport logistics and environmental management. It comprehends contents about the administrative legal protection of the marine environment by the International Maritime Conventions (UNCLOS, SOLAS, MARPOL, STCW and others), as well as about maritime administration, port logistics, technical equipment and maintenance management.
In Figure 5.4 are given are given courses within Master's Degree in Nautical Science and Maritime Transport.

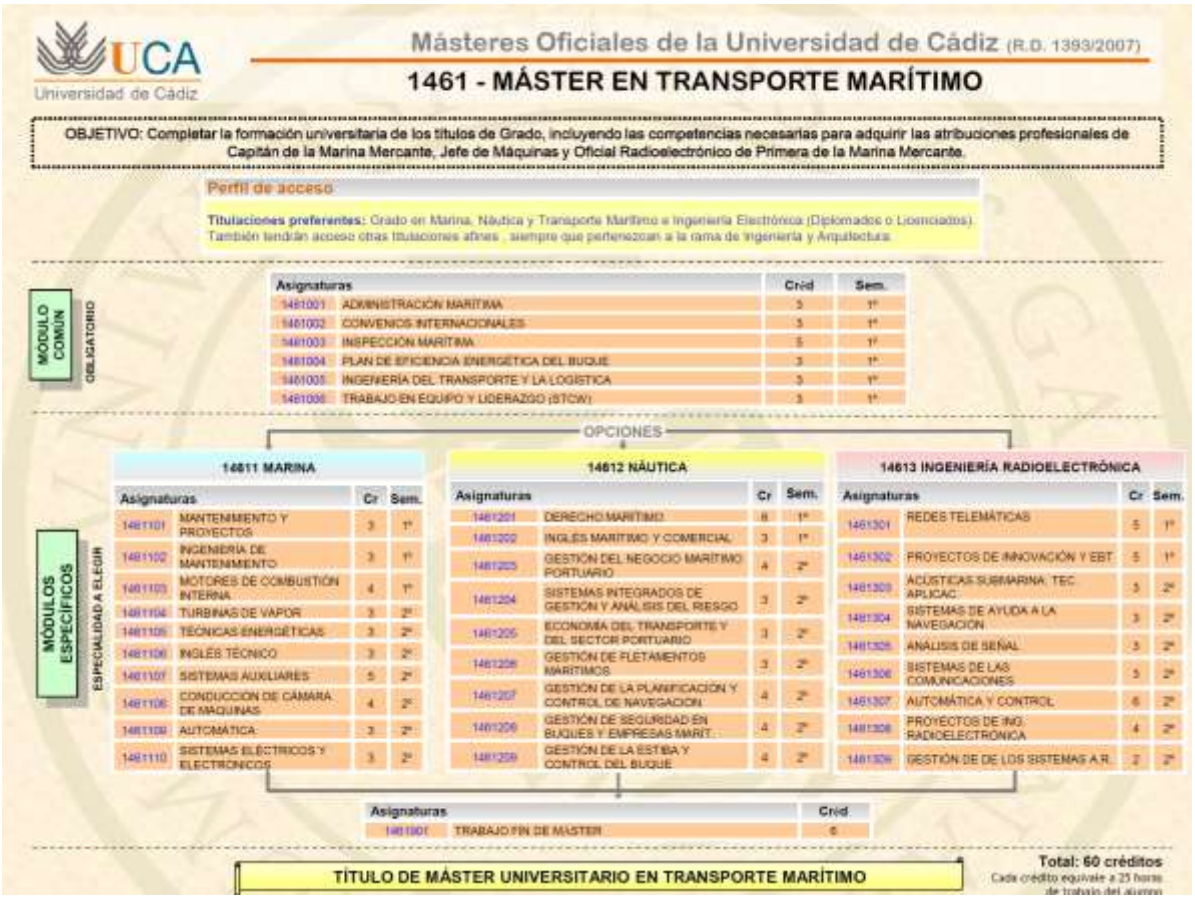


Figure 5.4 Courses within MSc in Nautical Science and Maritime Transport.

5.2 Educational framework and institutional practices

5.2.1 Design, organization and development of the training program

Coordination instruments. The design, organization and development of training programs for master's degrees requires intense coordination work. For this, the Boards of the Center[1] can constitute specific delegated commissions; the most frequent ones:

[1] In Spanish: "Juntas de Centro" or "Juntas de Facultad"

- Master's Degree Coordination Commission[2]. Among its most important functions: Agree on the calendars, the schedules and the use of infrastructures, spaces and common resources.
- Master's Academic Commission[3]. Among its most important functions is the annual approval of the following documents: the Teaching Guides of the subjects, the detailed calendar/schedule of the degrees and the reports of the Quality Assurance System.
- Final Master's Projects Commission[4]. Among its most important functions: Review, agree and approve annually the offer of thematic lines and tutors; the proposals for assigning thematic lines/tutors to the students; the programming of the acts of presentation/defense of the Final Master's Projects[5]; etc.

Programming tools. Teaching Guides [6]are the backbone of master's degrees teaching: They are the subject programs and through them it is guaranteed that the teaching is carried out in accordance with the provisions of the Verified Memories of the degrees; in particular:

- *Competences*: The programs identify the competences that are developed through the different training activities and the contents that are taught; as well as those that are evaluated through each evaluation system. In this way, the passing of the subjects by the students ensures the acquisition of the corresponding set of competences.
- *Training activities*: They appear detailed by number of hours.
- Assessment systems: They are organized to ensure that the tasks performed by the students do not exceed the total number of hours of autonomous work that they must perform.

Bureaucratic and administrative management of teaching planning. All academic courses, the Teaching Guides are reviewed and updated by the professors responsible for each subject, endorsed by the coordinator of the master (to guarantee that they comply with the Verified Memories of the degrees) and, finally, published on the official website of the degree. All the planning of the academic year (Teaching Guides, calendars, schedules and assignment of teaching to the teaching staff) is completed and published on the official websites of the degrees before the enrollment period begins.

5.2.2 Application of the Quality Assurance System of Cadiz University to master's degrees.

The University of Cádiz (UCA_S) has a Quality Assurance System that has been applied to all its centers and degrees since 2008 (revised in 2010, 2012, 2015 and 2017; currently again under review). Said system is oriented towards the continuous improvement of degrees and is equipped with the necessary mechanisms and procedures to obtain information on the development of degrees' implementation.

Most outstanding elements of Cadiz University Quality Assurance System:

[2] In Spanish: "Comisión de Coordinación de Másteres (CCM)".
[3] In Spanish: "Comisión Académica de Máster (CAM)".
[4] In Spanish: "Comisión de Trabajos Fin de Máster (CTFM)".
[5] In Spanish: "Trabajos Fin de Máster (TFM)".
[6] In Spanish: "Guías Docentes" or "Programas docentes de las asignaturas".

- Document Manager (active since the 2009-10 academic year): It is a fundamental consultation tool for all the agents involved in the quality of the titles. This tool collects all the procedures of the Quality Assurance System and allows registering each of the documents required by the System (each record indicates the delivery date and the person responsible for its completion); it is organized by campus, center, degree and academic year.
- Quality Assurance Commission[7]. Each center of Cadiz University has its own commission. It is the body that deals with the monitoring, evaluation and quality control of the degrees that are the responsibility of the center; always ensuring compliance with the objectives included in the Verified Memories of said degrees. These committees prepare, supervise and approve all the documents related to the procedures of the University's Quality Assurance System; in particular: reports related to the monitoring, improvement and renewal of accreditations of degrees. In addition, any modification in the verified reports of the degrees must have the approval of the Quality Assurance Committee of the Center.

Highlights of the quality assurance procedure:

All master's degrees must submit an annual monitoring self-report. In that document, the results of the quality indicators are collected and interpreted, the objectives of the degree with respect to said indicators are indicated, weak points are identified and proposals for improvement are proposed through an Improvement Plan. The Improvement Plan also reflects the monitoring and degree of annual achievement of the proposals. In addition, both documents must reflect and respond (by proposals for improvement) to the recommendations made in the internal audits of the university itself (carried out by the General Inspection of Services); and those raised by the Andalusian government institution competent in this matter (the Andalusian Knowledge Agency[8])) in their respective reports (verification reports, modification reports, monitoring reports and accreditation renewal reports).

In September 2020, the Faculty of Marine and Environmental Science obtained the certification of its Quality Assurance System (IMPLANTA Program, from the Andalusian Knowledge Agency). As of that date and while the certification is maintained, all the degrees for which the center is responsible, will jointly carry out both the monitoring and the renewals of the accreditations.

5.3 Joint degree programs

Master's degree in Integrated Coastal Zone Management (ICZM) has a Specific collaboration agreement between the University of Ferrara and the University of Cádiz for the establishment of a joint Master-level academic program called “Coastal and geo-resources management”, based on two official master's degrees from the participating universities (currently in the process of being renewed). This agreement includes the study plan that is applied to the students who participate in the Program, with the equivalence between subjects for subsequent recognition at each university.

[7] In Spanish: “Comisión de Garantía de Calidad (CGC)”.
[8] Official name (in Spanish): 2Agencia Andaluza del Conocimiento (AAC)”.

Each academic year, a maximum of 5 students enrolled in the Laurea Magistrale (+2) in Scienze Geologiche, Georisorse e Territorio (Classe: LM 74 Scienze E Tecnologia Geologiche)[9] of the University of Ferrara can participate in this program; and 5 students enrolled in the Master's Degree in Integrated Coastal Zone Management (ICZM) of the University of Cádiz. In the case of the University of Cádiz, 5 grants from the Erasmus Mundus + program are offered for the development of these mobility. This specific agreement is linked to Framework cooperation agreement between the University of Cádiz and the University of Ferrara[10] (currently too in the process of being renewed).

[9] Officcial name (in Italian): "Laurea Magistrale (+2) en Scienze Geologiche, Georisorse e Territorio (Classe: LM 74 Scienze E Tecnologia Geologiche)".
[10] Official name (in Spanish): "Convenio marco de cooperación entre la Universidad de Cádiz y la Universita' degli Studi di Ferrara".

6. Overview of distance learning methodology and technology at the University of Cadiz, Spain

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The master's degree in Nautical Science and Maritime Transport is the only one that has content related to MEP&M in whose study plan there are subjects that are taught online. There are 5 subjects, of 3 ECTS each, taught in the fall semester; in particular:

- International Maritime Conventions.
- Maritime Inspection and Control.
- Ship´s Energy Efficiency Plan.
- Logistics and Management of Maritime and Intermodal Transport.
- Leadership and Management of Maritime Industries.

In all of them, the Moodle platform is used as a "virtual campus", within which specific spaces are created for each subject where teachers who participate in teaching upload: the support materials to the classes; creating delivery tools of tasks and those of evaluation of the contents; and the teaching sessions.

Training activities (according to the verified memory of the master's degree):

- Online theory class: Study of the theory and consultation of the recommended bibliography.
- Online practices: Preparation of work in groups (delivered through specific tools), Seminars, and Group tutorials (through online video-meetings), etc.
- Assessment activities: individual academic tutorials (through online video-meetings), academically directed activities (with the corresponding support materials).
- Students Autonomous Work: study, elaboration of works (individual or group), etc. using the corresponding support materials.
- Evaluation: through specific questionnaires or by reviewing the documents delivered through the corresponding tools.

7. Multimedia Learning – trends and state of the art solutions in the academic environments at the University of Ljubljana, Slovenia

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Introduction

Availability of broadband connectivity, new software solutions as well as maturity of multimedia solutions influenced greatly the use of Information and Communication Technologies (ICT) in the pedagogical process in the recent years.

The following chapters present the brief overwiev of the trends and solutions that are being implemented in the advanced academic environments in the European Union, having in mind both, innovative pedagogical concepts, as well as technology trends.

The use of ICT in teaching needs to be focused on the pedagogy, high quality digital educational material and effective achieving of learning aims through innovative pedagogical methods. It shouldn't be technology driven.

When specifying digital learning solutions, most of the activities should be related to identifying suitable innovative pedagogical methods thorugh analysis and recommendations. Only when pedagogical challenges, aspects and needs are clearly identified and defined, the architecture of the digital learning solution can be derived and implemented, usually in the incremental way. As it will be seen from the following chapters, pedagogical requirements have to be translated into set of features that can be realized only through integration of different software applications into a unique solution.

There is no magic platform or application that would answer to all the requirements, however, performing an in-depth analysis and identification of the applications/platforms that may answer to as many features as possible, usually through adaptations and customizations, can simplify the development the final digital learning solution in the academic environment.

Therefore, we can observe the digital learning solution in the academic environment as a set of building blocks (applications), closely connected to each other through Application Programming Interfaces (APIs).

Appart from the software applications selected and used, digital learning solution comprises multimedia equipment in selected classroom, lecture halls or laboratories, set of hardware infrastructure supporting the software as well as specific software or hardware equipment used for remote laboratory work or simulations and tailored to the needs of specificsubject domains.

Technological research and development should focus on developing simple and usable, preferably unique interfaces for students and teachers. As already said, identifying software

applications that could support more then few functionalities (as many building blocks as possible) can decrease the complexity of implementation and especially further maintenance of the final digital learning solution.

The following chapters address multimedia/digital learning from three different perspectives: pedagogical/didactical, organizational and technical.

7.1 Educational framework and pedagogical practices: Overview of distance learning methodology and technology at the University of Ljubljana, Slovenia

Distance learning is not a new concept – its possibilities and challenges were discussed in many papers (Moore et al., 2011; Sherry, 1995; Valentine, 2002), however COVID 19 pandemic has induced significant shift to distance learning in the whole educational vertical, including tertiary education in order to assure continued education (Cicha et al.,2021; Schneider and Council,2020). Recent studies point out that over the years terms to distinguish between the highly variable design solutions (e.g. distance learning, blended learning, online learning) have been carefully defined and highlight the important differences between these planned and designed online experiences from the very beginning and a temporary shift of instruction being delivered as alternative to face-to-face courses due to crisis circumstances, known as emergency remote teaching (ERT) (Bozkurt and Sharma, 2020; Hodges et al., 2020; Toquero, 2021). After the first wave of pandemic and remote teaching, education institutions emerged with opportunity to evaluate its implementation and had the opportunity to learn, develop and prepare for implementing ERT in the second wave of pandemic (Hodges et al., 2020; Marek et al., 2021). Hodges et al. (2020) point out that the possible need for ERT must become part of a higher education member's skill set, as well as professional development programming for any personnel involved in regard with public health and safety concerns in the future (due to another virus outbreak, natural disasters etc.).

Recent studies (Hodges et al., 2020; Shoufan, 2021) emphasises the importance of student engagement for effective distance learning and report that videotaped lectures which have been a standard for some university and professional courses for some decades now, students perceive as less engaging, harder to learn some concepts and feel that longer lectures increase fatigue. Shoufan (2021) suggests some recommendations to improve student engagement in distance learning: » (1) Focus on active-learning techniques rather than passive methods; (2) Diverse distance learning activities to stimulate student motivation; (3) Offer ungraded or anonymous quizzes to improve understanding and engagement; (4) Offer more interactive sessions to avoid fatigue; (5) Combine synchronous and asynchronous learning formats« (pp. 41104-41105). Similar findings regarding importance of student engagement and focus on active learning in distance learning in the field of Science, Technology, Engineering, and Mathematics (STEM) education are reported (Norman, 2021).

The following guidelines in the document are based on the Digital Competence Framework for Educators – DigCompEdu (Redecker, 2017) with the educational framework and examples of practices of the ICT-supported pedagogical process conducted at the University of Ljubljana

(UL). The guidelines represent the possibilities of introducing new methodologies and pedagogical practices in various study programs at UL and beyond (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL, 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Priporočila za opremljenost šol z IKT, 2018; Vključevanje informacijsko-komunikacijske tehnologije v visokošolski pedagoški proces na članicah Univerze v Ljubljani: Analiza stanja didaktične uporabe IKT na članicah Univerze v Ljubljani s tehničnimi in organizacijskimi vidiki uporabe IKT, 2018).

The DigCompEdu framework (Redecker, 2017) (Figure 7.1) identifies six areas of competences with a total of twenty-two competencies, which express educators' digital competence. The six areas of competencies are divided into three sections: (1) Educators' professional competences, (2) Educators' pedagogic competences and (3) Learners' competences.

We focused on three main areas of educators' pedagogic competences required for effective and innovative use of digital technologies when planning, implementing and assessing teaching and learning according to DigCompEdu: Digital Resources, Teaching and Learning and Assessment.

Figure 7.1 The DigCompEdu framework (Redecker, 2017)

7.1.1 Digital Resources

In connection with the DigCompEdu (Redecker, 2017) area Digital Resources of competencies, needed for efficient and responsible use, creation, modification and sharing of digital resources in the pedagogical process, some study activities and ICT are presented below.

Based on the reviewed literature (Costello, 2017; Humanante-Ramos et al., 2017; Kerimbayev et al., 2020; Lucke et al., 2017; Norman, 2021; Violante and Vezzetti, 2017; Wallin et al., 2017) in the field of STEM, the use of existing digital resources (e.g. databases, animations, simulations and topic specific video lectures) that are available online and professionally prepared is widespread. Teachers often decide to create digital materials for students

independently. The preparation of materials further reflects in the preparation of variously complex tasks that require the use of prepared materials to stimulate, especially high order thinking skills (analyzing, evaluating and creating) in order to support the transferability of knowledge in new/future situations (Crawford et al., 2016; Ichsan et al., 2020; Rofiq and Nurwulandari, 2021).

Higher education teachers often use and create different digital resources that can be used in a traditional educational setting (face-to-face) or a blended/distance educational setting. For example, at the University of Ljubljana the recent evaluation (Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programme, 2020) found different teaching methods using digital resources as interactive experiments, demonstrations, motivational videos, weblinks, additional literature. Those materials teachers usually make available to students through an online classroom (e.g. Moodle). In addition, teachers often prepare even more interactive materials, such as quizzes (Moodle Quiz and Active quiz), questionnaires (Google Forms, Microsoft Forms, Moodle Questionaire), collaboration boards (Miro, Trello, Padlet), interactive materials (GeoGebra, Moodle H5P) and presentations (Moodle Lesson and H5P) and video content (published on YouTube, Vimeo, Arnes video). They also prepare study materials for peer evaluation (Moodle workshop) and submission of seminar papers (Moodle task), and materials for collaborative creation, project learning and experiential learning using different subject-specific tools (such as ArchiCAD, Rewit, AutoCAD, 3D Studio Max, Rhyno, Grasshopper, Adobe programs - Illustrator, Photoshop, InDesign, FontLab, Glyphs, Jupyter notebooks, Matlab, Mathematica, etc. (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL , 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.1.2 Teaching and Learning

In relation with the area of competencies in DigCompEdu (Redecker, 2017) Teaching and Learning, different learning approaches and study activities, supported with ICT, which are applicable in traditional study situations and blended/distance learning some of them are presented as follows.

Based on a review of examples of ICT use in the literature (Slof et al., 2010; Saitta et al., 2011; Craword et al., 2016; Eranki and Moudgalya, 2016; Samuel et al., 2017; Chen and Hwang, 2017; Violante and Vezzetti, 2017), we can conclude that in the STEM field of teaching, the use of ICT is common in support of different pedagogical approaches (e.g. project learning, inquiry learning, experiential learning). Next, we will look at some examples of ICT use to support specific approaches at the University of Ljubljana.

7.1.2.1 Inquiry learning

Inquiry learning is a constructivist educational approach that helps learners finding the truth, information or building knowledge. Classroom inquiry is often described as a series of repeated learning events, often called the inquiry cycle. It includes stages in which learners: (a) ask questions that are answerable or identify the inquiry problem; (b) prepare a plan and

take a first few measures; (c) collect sources, analyze and summarize information; (d) prepare conclusions and reports on findings; and (e) think about or reflect on the process of inquiry (Melero et al., 2012; Norman, 2021).

At the University of Ljubljana, higher education teachers use ICT to support inquiry learning, including various forms of experimental work (learning about abstract models, computing, data visualization, design of multimedia content, etc.), brainstorming and critical thinking. In addition, higher education teachers address the higher-order thinking skills through their activities with students. To support inquiry learning, teachers use various online software that allows a higher level of interactivity (e.g., Jupyter Notebooks, visualization tools). With the help of pre-prepared content, student made proposals for solutions to research problems, independently research various sources and literature, and adapt and upgrade their experiments and create innovative solutions for assigned problem situations (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL , 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.1.2.2 Collaborative learning

According to Dillenbourg (1999), "collaborative learning" describes a situation in which special interactions are expected among people, which triggers learning mechanisms. Collaborative learning puts students in learning pairs, groups or communities where, together with other members, they formulate questions, discuss ideas, search for solutions, fulfil tasks and reflect their thinking and experiences (Hsu and Ching 2013). Thus, learning is put in student-centred activities to create a shared understanding and develop critical and reflective thinking (Sun et al., 2018). ICT has been here used to support collaborative learning for reaching different learning objectives for decades.

Higher education teachers and associates at the University of Ljubljana (Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020) prepare various activities to encourage students to develop higher-order thinking skills. The activities vary according to the purpose and content of the collaboration between the students. Thus, students collaborate while preparing various projects and seminar assignments, designing contents, conceptualizing solutions in groups, evaluating their practical work in groups etc. They combined the use of online classrooms (e.g. Moodle) and different online tools (e.g. Jupyter Notebooks, Matlab, Mathematica, Kahoot, Socrative, H5P). In the STEM field, collaborative learning is often emphasized in activities where students are involved in activities that require a collaborative search for digital sources by using different bibliographic sources of information, web sites with different sources (e.g. computer games, stories, tools for creating materials, databases) etc. Higher education teachers also include students in the process of collaborative creation of materials. This can be carried out by using various software, e.g. platform for creating materials for assessment of the knowledge, creating interactive teaching materials for presentations and practice, creating digital stories, creating computer games, and creating concept cards. Along with collaborative learning, students also

learn to share created materials. This is especially remarkable through blogs, Wiki, different activities in the online classroom at Moodle, and social networks like Facebook, Instagram, TikTok (Rap and Blonder, 2017).

Through collaborative learning, teachers also took care of the professional engagement of students. Students coordinated their work with their peers and shared their knowledge in real professional communication by communicating through different communicative ICT (MS Teams, Zoom, Moodle) and by creating e-portfolios (using Wiki, Mahara etc.) (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL , 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.1.2.3 Project-based learning

Project-based learning is a holistic approach that organizes teaching and learning around projects (Thomas, 2000), including learners who explore authentic problems. With these methods, learners learn how to deal with real, complex problems and not with academic, simplified tasks while developing skills for autonomous learning and group work (Baihaqi et al., 2020; Balyk et al., 2021; Martínez-Monés et al., 2005). Traditionally, two essential components (Land and Greene, 2000) of project work are: (a) learners create a question or problem, which is used for organizing and encouraging learning needs, and (b) learners create a final product or a series of products for solving a stimulating question or executed problems.

The use of ICT in support of project-based learning, which encourages higher-order thinking skills in students, can also be traced among higher education teachers at the University of Ljubljana in the STEM field (Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020). Students used the Moodle online classroom to review learning materials, evaluate group work, and submit group reports. The group work took place in collaborative environments (e.g. Facebook, Trello, Asana, Basecamp) with the support of videoconferencing tools (e.g. Skype, Viber, Google Hangouts, MS Teams, Zoom), in which students did group work, shared materials, communicate with each other and give their suggestions and ideas. Dedicated subject-specific tools were used to create the final products of project work. They also used tools for sharing documents and materials (e.g. Dropbox, Microsoft OneDrive, Google Drive); some were also used for collaborative reporting. Finally, they presented, shared and critically peer-reviewed their final products using ICT (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL , 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.1.2.4 Problem-based learning (PBL)

Problem-based learning is a learning approach that equips learners to think critically, analyze and solve complex problems from real lives; find, assess and use appropriate learning sources; collaborate; demonstrate effective communication skills, and become lifelong learners

(Baturay and Bay, 2010). The three basic principles that separate PBL from those that do not implement this methodology are that it requires a problem that triggers learning, that PBL is not an independent teaching technique since it includes multiple teaching approaches and methods, and that it is almost always student-centred (Sendag and Odabasi, 2009).

Problem-based learning is also present as a form of collaborative learning. Problem-based work prevails in the area of STEM at the University of Ljubljana. Some teachers develop problem-based tasks for students and implemented them in online environments (e.g. Moodle) Other used problem-based tasks in a traditional way, where technology was used for acquiring information that enabled solving the problem (e.g. Wide Web, DiKUL, dLib, Web of Science). Some used ICT as a support for representing results of problem-based learning (e.g. PowerPoint, Nearpod, Mentimeter) (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL , 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.1.2.5 Experiential learning

According to Lewis and Williams (1994), experiential learning means learning from experience or learning by doing. After immersing learners in an experience, experiential learning encourages reflection about the experience to develop new skills, new attitudes or new ways of thinking.

Higher education teachers at the University of Ljubljana (Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020) in the field of STEM also use ICT in support of experiential learning, thus encouraging students to develop higher-order thinking skills through various activities for students, in which they experience themselves in the production of various products, such as various image products, plans, audio-visual media, analyses, etc., that means in situations that they will encounter in their careers. Teachers and students use a wide range of different dedicated ICTs. Experiential learning was also carried out in terms of students demonstrating more complex or abstract content using special software tools (e.g. SAGE) (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL, 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.1.3 Assessment

Lastly, in connection with area of competencies Assessment in DigCompEdu (Redecker, 2017) some study activities and supportive ICT, which can be used to prepare various forms and methods of knowledge evaluation and assessment in both traditional learning environment (face-to-face) and distance learning are presented.

Higher education teachers at the University of Ljubljana (Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020) in the STEM field prepare various tasks for students to evaluate their work and monitor progress using ICT. It is common to use quizzes to check (real-time) comprehension before, during and after lectures (Moodle Quiz,

Active Quiz, Kahoot), they also design various interactive tasks within the Moodle online classroom, which they then give to students to solve. Submitted assignments are often pre-checked by teachers with a text authentication program (Turnitin Assignment). Higher education teachers use ICT (Moodle, Padlet, Socrative), which enables immediate feedback on student work. They include peer evaluation in the study process, where students are encouraged to provide feedback on peer work, evaluation of final products and group work. Teachers use different ICTs for summative evaluation of knowledge. During distance learning due to the COVID 19 epidemic, the use of the Moodle online classroom (e.g., quiz, assignment), the MS Teams online learning environment (e.g., assignment), and the Exam.net tool were frequently highlighted. The security of knowledge testing is often ensured by using the Safe Exam Browser and by monitoring students via video conferencing systems (e.g., Zoom, MS Teams, BigBlueButton, Webex) (Poročilo o analizi stanja o znanju, kompetencah in veščinah didaktične uporabe IKT v pedagoških študijskih programih UL , 2017; Poročilo o rezultatih uvajanja novih metod in pedagoških praks v študijske programe, 2020; Smernice za didaktično uporabo IKT na različnih študijskih področjih, 2020).

7.2 Setting up blended learning – the institutional aspect

In 2003, Osguthorpe and Graham (2003) defined blended learning (BL) as a combination of face-to-face learning and ICT-based distance learning. They emphasize that BL is more than simply displaying links to web pages in an e-classroom, and that by combining the learning environments, teachers try to make the most of both teaching modalities. A combination of traditional classroom learning and distance learning is increasingly used in formal and informal education settings. In higher education, many institutions regard BL as an ideal modality with the lowest possible level of deviation from the traditional way of learning (Moskal et al., 2013).

The model of implementation of BL depends on the level at which it is introduced, i.e. the level of the course, department, faculty, university or the entire education system. At each level of implementation, it is necessary to provide the structure, strategy and quality of study. Educators have to be aware that e-learning is not a mere transmission of the subject matter in an online form, but involves student activities and independent work that enable them to build their own knowledge. Thus, in BL the aspects of quality assurance and learning outcomes are of primary importance, followed by the aspects of achieving financial efficiency, flexibility and accessibility.

7.2.1 Key aspects of BL: Policy/strategy

BL needs to be seen as an innovative potential and as such must be part of the institution's strategy. It must be precisely defined, adapted to the objectives of the institution's overarching strategy, and eventually routinized to become part of normal educational activities. In this process, the needs and activities of individuals (bottom up) must be synchronized with the needs and activities of the institution (top down), as uncoordinated action leads to collision and failure. According to Garrison & Kanuka (2004), strategy is key to the successful introduction of BL. The likelihood of success will further increase if the

institution has an additional team who takes care of this area. The implementation must be set up as a project, supported by the management, with financial and human resources provided and reasonable timeframes defined. Thus, BL must be based on the processes and activities that are clearly defined and understood by stakeholders in BL.

The BL strategy must set the objectives regarding the form and scope of BL, consistent with the defined purposes of the introduction of BL, and the strategy of the institution. The objectives can be defined from the perspective of the institution, teachers, or students:

- Institutional objectives may include e.g. a more efficient use of resources/tools to support the teaching, better student pass rate, or increased student enrollment.
- Teacher objectives may involve improving the teaching through development and introduction of innovative teaching practices.
- Student objectives may include greater comfort and flexibility of learning, unrestricted access to study materials, greater academic success, or better information literacy.

The following questions can be helpful in the process of developing a BL strategy (Moskal et al., 2013):

1. Why introduce BL at the institution? What are the objectives? What short-term and long-term results are expected?
2. What are the improvements from a student perspective (e.g. higher pass rate, fewer dropouts, shorter completion time)?
3. What BL courses or programmes will be offered and why?
4. How will BL be introduced at the institution? Who will be the first?
5. How will different staff members participate?
6. What investments are possible (time, people, finances, etc.) and what are the consequences?

7.2.2 Key aspects of BL: Organizational culture

Organization is an important factor because it determines whether the institution can train the teachers, develop the courses, manage and maintain the infrastructure, provide (online) support to students and teachers, and manage other important functions required for successful BL. There seems to be no single concept of organizational model for providing BL support. A centrally managed unit has proven to be a successful solution for supporting teachers and students, which effectively prevents duplication of work, while providing quality and consistent assistance for all. One of the key roles is played by the designer of learning units who helps teachers in setting up and designing e-classrooms.

The support staff often do not take enough time to become familiar with new terminology, technology, and new teacher and student tasks. When the support staff are aware of their role in BL, the introduction and implementation of BL are significantly more effective. Those who are trained for BL contribute to a positive attitude towards new learning technologies.

7.2.3 Key aspects of BL: Support

The BL support consists of several levels. In the development and establishment of BL, support is crucial for teachers who need knowledge to be able to prepare learning content and implement BL. They need support in technical and pedagogical activities related to the technology. From a technical perspective, this involves supporting teachers with a working technology and helping them use it. From a pedagogical perspective, it is important to provide teachers with support in connecting the teaching objectives with the functions and affordances of the technology. This can be done using theoretical findings or using good practices within the institution, considering the perspective of students at the institution. In BL, the teacher needs different skills/knowledge depending on their roles in the e-classroom (teacher, editor, organizer, tutor etc.). It is important that the teacher acquires some of them and leaves the others to the technical and pedagogical support staff.

Support should be provided to students at the beginning of the study when they are introduced to BL (pedagogical support to students), and later when they can already use the technology but face various technical problems (technical support to students).

Thus, two types of support can be identified:

1. Teacher support in the development of an online classroom: The transition to e-learning is a great challenge for teachers as they need to learn to use a new technology and change their way of teaching. The institution must provide them with the necessary training and support (designing of the e-classroom, choice of activities…), as they do not have the time (and willingness) to learn new things. Teachers' communities of practice can be very helpful (Garrison, 2011).
2. Student and teacher support during the implementation of e-learning: The e-classroom allows students and teachers to enter the pedagogical process regardless of time and space. The problems related to this can be simple or more complex. When a problem arises, the support must be offered promptly via telephone, email, messaging, information webpages (FAQs), instant messaging, video tutorials and the like. Most institutions that already have well-established e-learning use several options.

7.2.4 Key aspects of BL: Ownership

An important element is the arrangement of the ownership of BL content. The emerging online content is copyrighted (like textbooks or other study materials) and the institution must properly regulate this area, as accessibility in the online environment is wide and often difficult to control. All online content created in online learning systems should be the property of the institution. This area has to be regulated similarly to the publication of textbooks and other teaching aids.

Unlike printed materials, e-materials can be copied very easily or made available to the public. Therefore, teachers' fear of public sharing of knowledge with competitor teachers or institutions is often justified and needs to be addressed appropriately.

7.2.5 Key aspects of BL: Evaluation of teachers' work

Traditional teaching is evaluated with the hours delivered in the lecture hall. A teacher and student class time lasts 45 minutes (in Slovenia) and is used in the course curricula to define student workload related to ECTS credit points where one credit point is defined as 25-30 hours of student work or student workload. In BL, however, pedagogical work is evaluated differently. Workload in BL is regarded as an addition to the work in the lecture hall (Ellis et al., 2009). It is the task of the institution is to set the framework for evaluating the student work in the e-classroom and the work of the teacher in the e-classroom.

Research shows that incentives have a positive impact on the successful development and implementation of BL (Watson et al., 2011, p. 148). Incentives are especially important at the stage of the introduction and creation of content in the online environment. The most common motivators are the mandatory elements, such as:

- BL is a normal part of the pedagogical process and is also evaluated as such,
- BL is included in the conditions of promotion,
- BL is included in the habilitation conditions.

On the other hand, motivators can also be:

- material incentives (technological equipment, financial compensation, free training),
- increased weight of the course in the evaluation,
- additional hours for development of BL and consequent unburdening from other obligations,
- additional help offered (additional assistants).

7.2.6 Key aspects of BL: Policy evaluation

Evaluation is a necessary element of BL, which includes the evaluation of individual components within the BL strategy and ensures the development of the field. Teachers take evaluation more seriously especially when a financial incentive is included in the development of BL as they have to prove a “return on investment” (Sharpe et al., 2006).

Evaluation of the implementation of the BL must include the following stakeholders:

- teachers (satisfaction, teaching quality, achievement of course objectives),
- students (satisfaction, user experience, achievement of course objectives),
- technical and administrative staff (satisfaction, adequacy of processes, performance of tasks),
- technology (relevance, reliability, safety, scalability).

Watson et al. (2011, p. 44) suggest that evaluation should be done on outputs rather than inputs. Outputs should be in line with the institution's strategy. Evaluation should especially focus on student achievement and their relationship to BL (Ellis et al., 2009; Ginns & Ellis, 2007) as well as opportunities. It is important that all stakeholders are informed about the

results of the evaluation, which is also one of the principal elements of success. Moskal et al. (2013) argue that continuous evaluation can effectively map out the effect of BL on students, teachers, and the institution.

7.2.7 The BL institutional model

In view of the above, BL must be considered comprehensively while also determining its individual segments. These must be precisely defined and appropriately implemented. Therefore, we propose the following framework for the institutional model of BL:

	Categories						
		Implementation of BL			Quality of implementation		
Level	Policies and objectives	Training/ Empowerment	Processes	Support	Remuneration	Evaluation	Incentives and rewards
Strategic	Definition of strategic objectives of BL	Definition of training strategy	Definition of BL implementation process - strategic aspect	Definition of method and implementation of support	Definition of BL remuneration system	Definition of criteria for evaluation of BL implementation	Definition of incentive and reward system at strategic level
Pedagogical	Definition of pedagogical goals of BL	Definition of the system of training of teaching staff for the pedagogical aspect of BL	Definition of the implementation of pedagogical process	Definition of the support system for teachers for the implementation of BL	Definition of remuneration of the work of teachers and students	Definition of criteria for the evaluation of teaching in BL	Definition of system of incentives and rewards to teachers for implementation of BL in the course
Technological	Definition of technological goals in BL	Definition of training system for the use of technology for teachers, administrative and IT support staff	Definition of the process of using IT at the level of institution (annually, LMS) and course (course implementation date)	Definition of technical support for students, teachers and administrative staff	Informatization of remuneration system, especially at the level of support for remuneration, registering and reporting processes	Definition of criteria for the evaluation of technological processes to support BL	Definition of systematic incentives for technological support to BL

Figure 7.2 Framework for the institutional model of BL

7.3 The Next Generation Digital Learning Environment (NGDLE)

As a natural extension (or confirmation) to the arguments so far, another concept needs to be considered when designing a unique Learning Environment.

The Next Generation Digital Learning Environment (NGDLE) is a concept proposed by EDUCAUSE Learning Initiative (abstract of the concept can be found on the following link https://library.educause.edu/~/media/files/library/2015/4/eli3035-pdf.pdf), trying to overcome the gap between current ICT learning tools, used in the academic environments and a digital learning environment that could meet the changing needs of higher education.

The concept derived from consultations with more than 70 higher education community leaders and focuses on following principal functional domains:

- interoperability,
- personalization,
- analytics, advising, and learning assessment,
- collaboration and
- accessibility and universal design.

Since no single application can deliver in all those domains, NGDLE recommends a "Lego" approach to realization, where NGDLE-conforming components are built so that they allow individuals and institutions the opportunity to construct learning environments tailored to their requirements and goals.

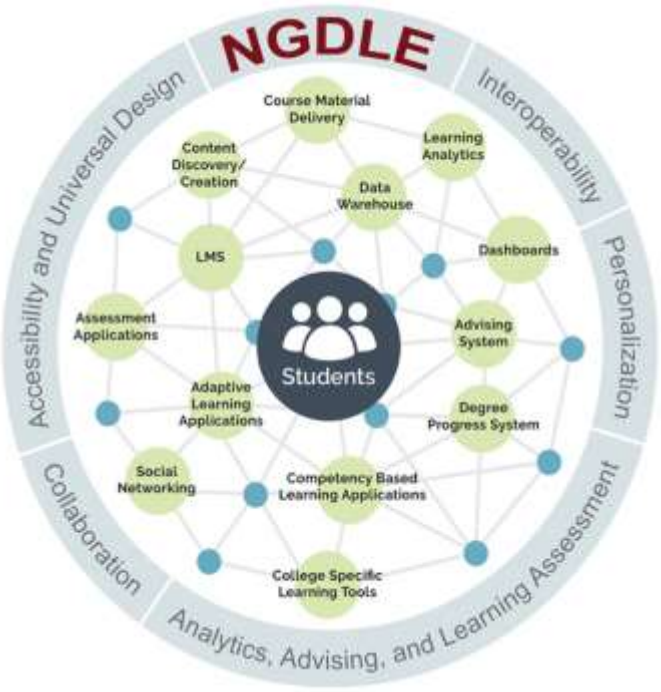

Figure 7.3 NGDLE "Lego" approach to a unique Learning Environment

In order to explain and comment upon, we need to go back into history of the digital learning (r)evolution. In the previous years (from early 2000 to approx. 2015) the e-learning was predominantly based on a single software solution that would answer all the needs of the educational process. It is called the Learning Management System (LMS) and provides features of user (students) and group (classes) management, delivering of the digital learning materials, assessing the knowledge, grading and tracking the progress of students. It is a rigid solution, limiting educators as well as students in the way the educational process is performed and putting technology first. The possibilities of personalization, collaboration and other domains were limited. In other words, instead of the students in the center of the figure (Figure 7.3), the LMS was in the center of the ICT supported educational process.

Gradually, e- learning developers started introducing additional concepts ranging from talent management, blended and social learning, to personalization and diversification into digital learning scenarios, making Learning Management Systems more complex and soon finding out that a single solution can never solve all the problems.

Instead of building on a single solution, the challenge now is on integrating different applications into a single, simple to use and personalized learning environment for students.

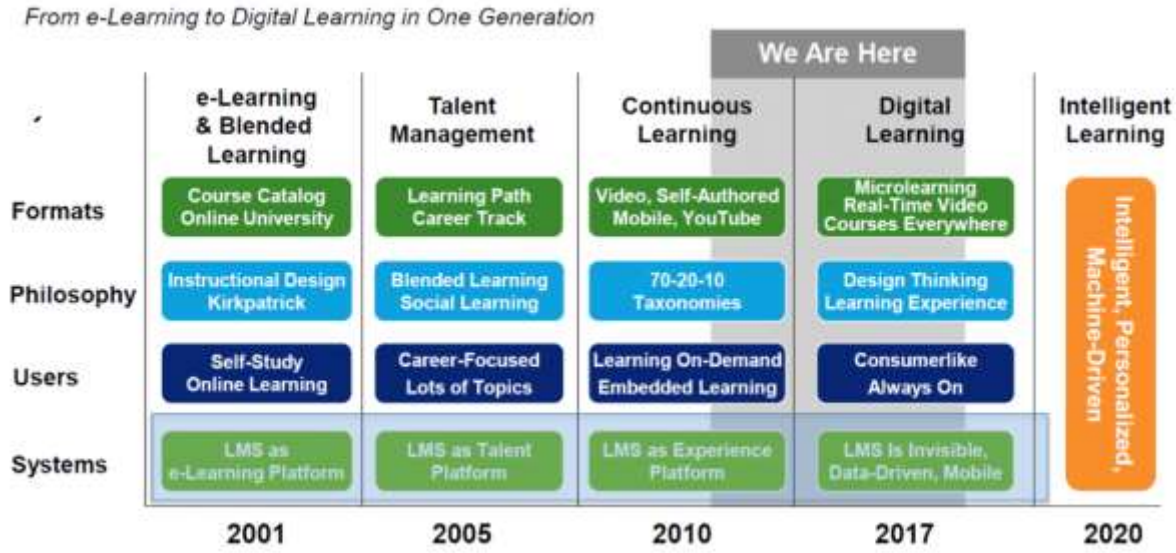

Figure 7.4 Evolution of digital learning (source: Bersin by Delloite, 2017)

7.4 Technical approach: towards Learning eXperience Platform (LXP)

Before addressing the more concrete proposal of the architecture of the integrated, unique learning environment for the higher education institution, let's mention another concept that is being considered and developed in the recent years.

Learning eXperience Platform (LXP), unlike in the past, focuses on improving learners' experience instead of managing learning programs/courses/users.

While there's a lot of feature variation within the category, LXPs can be roughly divided into three groups:

1. those that concentrate on personalized content delivery (along with Artificial Intelligence based recommendation engines,
2. those that focus on facilitating social learning and collaboration, and
3. hybrid platforms that combine content delivery capabilities with social features.

Although the term platform is used and some commercial providers are in fact promoting it as a single solution, commonly, in academic environments, due to their specific needs, it is usually being incrementally developed as a set of different, but integrated applications with additional software developed, providing the best possible user experience for the students.

This additional software may comprise of:

- APIs, connecting the applications used as well as the external applications, not being the part of LXP, such as student administrative information systems;
- Single Sign On (SSO) capabilities, fully taking care of AAA (Authentication, Authorization and Accounting);

- additional web/mobile front end interfaces for students, enabling them to access digital materials, tasks and exercises and everything else related to their study on a single workspace (web page) in order to provide the best possible user experience, preferably independently of the application used to deliver the assets listed above (eg. LMS, videoconferencing tools, repositories).

When speaking about LXP, we are building on the previously identified concepts of focusing on functionalities and use cases (DigCompEdu) and integrating different applications (NGDLE) into a unique learning environment, focused on the best possible user experience (LXP).

7.5 Digital Learning and COVID 19 pandemic

Apart of the concepts that were presented in the previous chapter, current situation regarding the Covd19 pandemic affects the importance as well as the performance of digital learning in the higher education institutions.

On one hand, the pandemic has positive effect on digital learning in higher education. It fosters the use of specific tools in education, (such as videoconferencing) that were previously not as present, additionally, it increases the need for improvement of the ICT and networking infrastructure within the institutions and generally puts higher priority to the digital learning in the higher education.

On the other hand, it clearly shows the unpreparedness of higher education institutions for digital or online learning and that some parts of the educational process are difficult to perform, or even cannot be replaced with technology at all. It also shows the weak spots that need to be addressed, predominantly in the lack of existing skills and competencies among educators and in some cases, the need for provisioning of the appropriate digital learning environment that would suit the needs of the educators.

As an example, substantial amount of digital learning content was created recently within remote lectures performance, or as additional study materials for online study on behalf of the professors/educators in form of video materials. The first question that arises is, where to store these materials. It needs a lot of space on the servers, these materials need to be delivered to specific users (students within the course, within the institution, publicly, etc.) in different scenarios, they need to be searchable and there are additional requirements as well.

Such findings are of crucial importance, when planning the digital learning environment for the higher education institution.

7.6 Digital Learning Technologies

The concepts presented above, provide us with insights, how to implement optimal digital learning solution for the academic environment performing blended learning.

First, **the methodology followed** should encompass the analysis in the initial stage, that would lead us to desired functionalities of the digital learning solution and related

DigCompEdu competencies that need to be supported by the solution. The **analysis** should be guided in terms of common questionnaires or semi structured interviews, but have to be performed within the academic institutions.

After completing the analysis, **the selection of applications**, comprising digital learning solution needs to be performed. As already stated, it is generally not a single application/platform. Apart from the criteria that is based on the functionalities, the following criteria regarding applications/platforms identified should be considered as well:

- applications/platforms that can cover as many functionalities as possible
- applications/platforms that are customizable
- open source or commercial applications with lowest possible future maintenance costs

Subsequently, **the solution architecture document** along with the specifications, comprising integration APIs and possible additional customization of the applications should be prepared.

In the next stage, the implementation of the solution along with the training of the ICT and selected pedagogical staff in partnering institutions will take place. This training will consist of the technical aspects related to the solution developed, as well as pedagogy aspects. It is envisaged that further training of the pedagogues will be performed locally, within the partnering institutions themselves.

Based on the implementations in other higher education institutions and on the concepts presented above, we can speculate about the functional segments/applications that will need to be the part of the final solution.

7.6.1 Technologies for "Teaching and Learning (DigCompEdu)"

First and foremost, "**teaching and learning**" functionalities are still best supported through **Learning Management System (LMS), such as Moodle**. Moodle is presumably best known and used LMS. However, in cases when higher education institution is not using the Moodle already, its functionalities can be replaced with different simplified solution, again, based on the need's analysis. The core functionality of the LMS that need to be supported are:

- the organization of the courses for the students,
- presentation of the activities, students need to perform,
- knowledge assessment (tests, quizzes) and grading

Next to the LMS, the solution will also consist of a **videoconferencing/lecturing platform**. The desired functionalities of such platform are usually the following, to name the few:

- video lecturing with application sharing capabilities (preferably more than one participant can share at once), polling, drawing on the virtual board, etc.
    - video lecturing where all participants have the same level of interaction (video, audio, chat)

    - video lecturing where teachers share video, audio and screens and the rest of participants follow the lecture and interact through chat
- recording of the lectures
- collaborative work (eg. team work within breakout rooms, common editing of e-documents)
- the best possible integration with the LMS (Single sign On, creation of video lectures from LMS)

Most videoconferencing tools are available as the **solutions in the cloud (e.g. MS Teams, Zoom)**. These solutions have advantages, since the institution doesn't have to take care of the complex infrastructure needed (in terms of hardware and connectivity). On the other hand, these solutions are related to additional licensing costs which increase rapidly when extending desired functionalities. They also may have limited integration possibilities.

The alternative is the use of Open Source solution called **BigBlueButton (BBB)**. It can be installed on the premises of the institution; however, it requires expensive infrastructure and connectivity and it lacks some features that may be required by the target environment (e.g. the teacher can follow only one screen share of the student at once which makes performance of some remote exercises more difficult, complex recording of the lectures performed).

There are also solutions that are commercially available, but can be installed at the premises of institution in different setups. One of such solution is MediaInteractive platform (MiTeam), which would be interesting to follow, since it supports more functionalities than just videoconferencing.

Depending on the analysis findings, the "teaching and learning" functionalities can also be supported by additional software, such as e-portfolios (e.g. Mahara), responsive systems (Socrative, Mentimeter…) and others.

At this point we could mention the need to support the students' progress tracking functionality. Since progress tracking is usually supported only within the LMS itself, when using other applications for teaching and learning, we need the capability to track progress from those applications as well (e.g. collaborative environment, video conferencing, Multimedia Repository). This is done by implementing so called **Learning Record Store (LRS)** that is based on the standardized protocols, including xAPI.

7.6.2 Technologies for "Digital Resources (DigCompEdu)"

In terms of **"Digital Resources" functionalities**, we can distinguish **creation/modifying** of resources and **storage/management** of digital resources. Creation/modifying is performed with **desktop or cloud applications**, whereas storage and management of digital resources is performed within the **Multimedia Repository.**

Creation/modifying of e-documents is performed with existing, well known desktop applications. These learning materials can be stored and structured in the LMS.

Creation/modification of video, multimedia learning materials is a different story. Video clips, screen captures, animations and similar can be created with desktop applications. Video

lectures can be created as recordings from videoconferencing systems. In case that the lecture is performed in the classrooms, the **Lecture Capture system** is usually used.

Video learning materials need to be stored in the Multimedia Repository. It has to enable structuration/categorization of the materials and meta data insertion, different level of access to the materials, it needs to support streaming capabilities and it needs to be integrated with the LMS used. It also needs to be integrated with the videoconferencing system in order to store the recordings. Last but not least, it needs to be integrated with the lecture capture system.

Most of the applications in this category already exist or were mentioned previously. However, one important application, that is **Multimedia Repository**, will almost certain need to be the part of the digital learning solution. Unlike in the previous examples, there are no off the shelf solutions (without significant adaptations) available for the repository.

In some cases, commercial providers of the Lecture Capture systems provide the repository as well. This proves to be effective solution, but is very costly. In some cases, environments that are based on the Microsoft 365 environment use their solution called the Stream and OneDrive. It lacks lots of functionalities and needs to be adapted extensively. Alternative to the above-mentioned solution can also be the Google software or Dropbox. Again, adaptations need to be performed (integrations) and cloud dependency outside of the institution exists.

Another approach would be to use **MediaInteractive platform MiTeam**, which apart from the videoconferencing capabilities encompasses the Multimedia Repository as well, with most functionalities already implemented and only target environment customizations required.

The **Lecture Capture** functionality is usually implemented through commercial providers solutions (e.g. Caltura, Mediasite). These solutions are effective but costly. Alternative is to use open source OpenCast platform which requires lot of adaptations and programming. Since Lecture Capture is only meaningful in multimedia equipped classrooms, to support the functionality, combination of existing application can be used as well (**e.g. OBS, MiTeam**).

7.6.3 Technologies for “Assessment and Empowering users (DigCompEdu)”

Functionalities from “Assessment” segment can initially be supported through selected LMS capabilities and subsequently, according to analysis results, expanded with specific solutions. Empowering users, within the digital learning solution will be done by implementing personalization functionalities on the top of integrated applications within the digital learning solution.

7.6.4 Summary and the scheme of proposed solution

Applications envisaged so far, can be summarized as follows:

- LMS Moodle (alternatives possible)
- Videoconferencing (alternatives Zoom, MS Teams, Webex, BBB, Jitsi, MiTeam)
- Collaborative environment (alternatives Moodle, Google, MS 365, MiTeam)

- Multimedia Repository and Lecture capture (may be based on various alternatives)
- Experimental environment (testing or use of alternative applications for teaching and learning, such as polling systems, e-portfolios, etc.)
- Single Sign On, APIs for integration of applications and integration with external applications, Learning Record Store.

The scheme in Figure 7.5 shows the proposed architecture of the Digital Learning Solution.

7.6.5 Multimedia equipment

Multimedia equipment in the premises of the academic environment represents an essential tool to perform multimedia supported education. It enables streaming or recording of educational lectures, laboratory work or other learning activities. It needs to be considered from three different perspectives before selection:

1. Purpose
2. Resources
3. Budget available

In terms of **purpose**, multimedia equipment is generally used in conjunction with selected **videoconferencing tools**, such as Zoom, Teams, CISCO Webex, BBB, or other.

Additionally, **lecture capture** technologies (software or hardware) can be used, enabling automatization, therefore simplification of processes related to recordings and delivery of the video materials to different target groups of students. In such optimized case, it is important to envisage multimedia repository that is connected to videoconferencing tool as well as lecture capture system (in many cases, the repository may be the part of lecture capture system.

When selecting the equipment to be used, it is important to assess which of the following scenarios are going to be included:

1. live webinars: regular lectures from classrooms or teachers cabinets, streamed and/or recorded for subsequent use; the level of interactivity is lower compared to some other scenarios, students are mostly viewers and listeners, commenting via chat predominantly; used in larger groups of students or for the audience that may be partly present in the classroom and partly from arbitrary other locations; The quality of such material is generally lower, the simplicity of production (live) is the highest;
2. professional meetings: lower number of participants, more control of the environment, higher quality possible and higher interactivity may be reached. Usually, this may be used in a scenario where all the students are present in a controlled environment, assuring higher bandwidths availability, for example: in classrooms across different universities and not from homes with arbitrary terminal equipment. Video and audio communication is supported from all locations, higher quality of video is possible, however, this scenario calls for higher quality cameras, audio equipment and assured broadband availability.
3. offline pre-recorded materials: in this case, teachers prepare their recordings in advance. This enables higher quality of video materials, there may be more editing and postproduction activities involved, however, the effectiveness of such materials

(shorter, enriched with additional activities, more interactive) can be higher and meet the expectations of students accordingly.

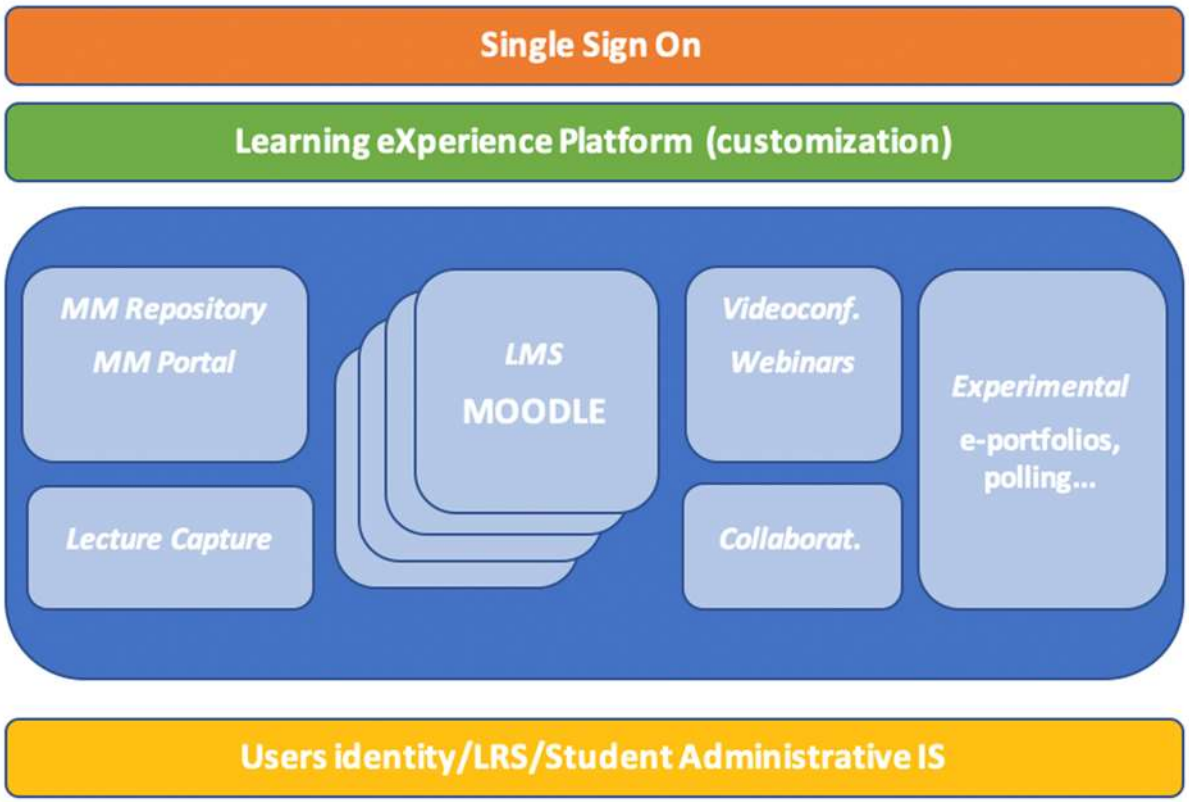

Figure 7.5 Proposed architecture of the Digital Learning Solution

The purpose of the multimedia equipment is also related to the following strategic question. Is it more important to have the higher number of the video materials - quantity, or in other words, to support most of the pedagogical process with video lectures, or is it more important to have lower number of video materials, but with higher quality?

Based on this answer, if the **quality** is more important, then the equipment is generally more costly, therefore less classrooms can be equipped with it. In this case, it is also crucial to focus on the "studio" equipment setting that enables recording of the high-quality material. This is also related to more effort and more work in terms of postproduction and preparation of video materials for the students.

If the answer to the question is that the **quantity** is more important, then more classrooms should be equipped with less costly cameras, audio systems, etc. and the focus should be more on the automatization processes (lecture capture system).

When thinking of the **resources** to be used, it is important to clearly plan the premises (lecture rooms, laboratories, studio) to be equipped as well as to envisage the availability of the staff that will support the video creation and delivery to the students. Less staff available, more automatization is necessary. If professional staff will be available, then high-quality equipment purchase makes sense.

Figure 7.6 equipment bundles – from simple and for personal use (cabinets) to complex and professional

Finally, in terms of **budgeting** issues, it is important not to forget that the equipment is only the part of the costs of implementation since it is the one-time cost. The assistive staff is very important and needs to be considered during the planning process.

When planning the multimedia equipment, the good approach is to design **equipment bundles** (consisting of specified cameras, audio, cabling or network based, appropriate simple or more complex hardware), considering aspects written above. For each bundle there should be clear purposes, features, limitations, basic schemes, price range and target users defined.

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8. Concluding remarks

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This Report represents an outcome of the first work package WP1 DEV 1.1., giving an overview of state of the art of master programs in field of Maritime Environmental Protection and Management and e-learning methodologies and technology at the EU MEP&M project partner HEIs, Université Côte d'Azur from Nice in France, University of Cadiz from Cadiz in Spain, and University of Ljubljana from Ljubljana in Slovenia.

It will be taken into consideration for GAP analysis of EU and Montenegrin and Albanian HEIs in the field of MEP&M, within the same work package under DEV 1.2.

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