Digital Toolkit for Green Skills

Enhancing green skills, sustainability, and attractiveness of Maritime VET.

Green Diving

WWW.GREEN-DIVING.EU

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SECTION 1: TOOLKIT RATIONALE AND CONTEXT

1. Introduction

The valorization of environmental issues and the implementation of sustainable concepts and behaviors in schools and professional fields increased in recent decades. Due to the increasing relevance and urgency of sustainability issues, the European Green Deal officially established the focus on green skills, sustainability, environmental awareness and the fight against climate change as fundamental priorities for the European Union's strategy, across all areas and sectors of the Union.

These priorities lead to a demand for the implementation of green competencies in most economic sectors and to widespread debates on how to achieve the transition to a green economy. In this sense, every professional sector must contribute to making the economy more sustainable, and education and training have a clear role to play. Indeed, implementing green competencies in VET provides an enhanced means of equipping youth and adults with the skills needed in the changing world of work, including the knowledge and competencies needed to transition to a green economy and society.

Based on this, the Green Diving Project will provide educational resources that incorporate sustainability and green skills, focusing specifically on the marine VET pathway. It is important to underline that the contents developed within the Green Diving project will take into account the European relevance and needs in the field of green competences and empowerment of educational actors for sustainability, including in the field of maritime education at different levels (capacity building, provision of resources, updating of curricula, greening of structures and processes...) - confirmed by important studies (CEDEFOP, UNESCO, UNEVOC) and projects (MATES, SKILLSEA, ONBOARD).

In general, the Green Diving project has specific goals to help disseminate sustainable policies and practices in educational and professional settings:

• Promote sustainability, climate change awareness, and green skills related to the maritime sector, both among VET teachers/trainers and VET students.

• Support professional development for VET teachers and trainers who contribute to higher quality education by updating teaching methods with a focus on green skills and sustainability.

• Strengthening the capacity of school leaders to deepen their knowledge of sustainability and the transition to a green school.

• Significantly increase students' sustainability skills to qualify them for the growing need for green skills in the maritime job market.

• Strengthening collaboration between different levels of education as well as different stakeholders such as educational actors, business, and others.

• Improve the attractiveness of VET and the public's perception of the maritime sector and its professions as contributing to ocean literacy and sustainable ocean management. These objectives are to be achieved through the development of 3 main outcomes presented below.

To achieve the proposed goals and expectations, the project will implement three main deliverables. The first is the development of a digital toolkit for Green Skills.

Second, the definition and preparation of a Green Skills course for VET Teachers Professional Development, and third, an Action Plan for Greener VET Maritime Schools. This document represents the first phase of this project, the preparation and implementation of the toolkit.

2. Introduction to the Digital Toolkit for Green Skills

This toolkit provides a set of tools, materials, and resources that will **enable VET maritime teachers and VET maritime schools** to integrate, explore, and develop green and sustainable skills at the macro level (school level) and micro level (classroom/student level).

This digital tool will provide theoretical information and didactic digital materials that can be used by teachers and school leaders in their educational institutions to teach Green Skills to instructors/trainers and students.

In terms of content, this document is based on a set of Green Skills and Competencies identified by the Consortium, which is composed of professionals in the field. However, the content and competencies will also take into account existing resources and projects related to sustainability, such as Green Comp, ESCO, SKILLSEA. Thus, the document will present a series of lesson plans and projects/activities that can be implemented in schools and classrooms based on each defined skill.

As this digital toolkit for green skills aims to promote the attractiveness of blue careers both among both VET students (future maritime/blue professionals) and regular pathways students, a list of occupations related to the maritime education pathway is presented in this document.

Following this line, the toolkit will also provide a set of best practices and additional resources that can be useful for teachers and school leaders to get more information about some important topics that can be useful in the maritime field.

It is important to emphasize that all the content presented in the toolkit will take into account the **specific offer of the partner VET schools as well as the levels of EQF 4 and 5 levels:** Fisheries, Maritime Transport, Port and Shipping Management, Marine Engineering. Moreover, all content will be translated into Portuguese, Italian, English, Spanish and German and will be available on the project website at no additional cost.

3. Target group and Pilot Project

The theoretical and practical content in this toolkit was created specifically for VET teachers/instructors who are engaged in maritime educational courses (navigation, port and shipping management, marine engineer, marine engineer, naval administration, or related courses such as electrotechnical engineering and engineering that may lead into the maritime field) and maritime education leaders. Both will implement content at the macro and micro levels.

One of the main goals of the toolkit is the validation of the content by teachers and students by piloting the toolkit in schools. To this end, once the final version of this document is made available, the content will be tested in at least 4 VET schools with the participation of 2 teachers per institution and a total of 120 students. Teachers will

present no less than 4 materials to their students and provide feedback to improve the content for the final and official version of the toolkit.

In this sense, the content will indirectly reach the Initial VET students/trainees (aged 15-25) in a VET Maritime Pathway, who will not only participate in the testing phase, but also after the completion of the project, each time an instructor decides to use the toolkit in his classes.

SECTION 2: GREEN SKILLS AND RELEVANT RESOURCES

1. Overview of Green Comp:

The European Commission has developed *GreenComp* as a reference framework for sustainability competencies at the EU level. In this sense, *GreenComp* provides guidance for educators by establishing a consensual definition of the meaning of sustainability as a competence and by defining a set of common values and skills that are closely linked to sustainable behaviour.

The framework was developed to support education and training programmes for formal, non-formal and informal learning sets in the belief that the competencies presented can help learners to become "critical thinkers, as well as develop agency, and form a knowledge basis for everyone who cares about our planet's present and future state." (Bianchi et al., 2022, p. 2).

Like Green Diving, *GreenComp* aims to respond to the existing and growing need for people to improve and develop their knowledge, mindset and attitudes and act more sustainably. The only way to ensure this is through education and the teaching of shared values to bridge and minimise our individual impact on the environment, and that is why this resource is so important for teachers and educators in various fields, including maritime.

On this basis, *GreenComp* provides a reference model that anyone who is part of lifelong learning can use to create learning opportunities focused on developing sustainable competencies. Accordingly, the framework presents a set of twelve competencies organized into four domains:

1) **Embracing Sustainability values** (valuing sustainability, supporting fairness, and promoting nature).
2) **Embracing complexity of sustainability** (systems thinking, critical thinking and problem framing).
3) **Envisioning sustainable futures** (future literacy, adaptability, and exploratory thinking).
4) **Political agency** (political agency, collective action, and individual initiative).

In general, such a shared understanding can serve as a catalyst for learning about environmental sustainability through the support of educational institutions, which can freely use and adapt the content to their visions, needs, and practices when developing content for teaching sustainability to their students. Therefore, this reference was used as one of the guides for defining a set of skills that are presented in detail in this Green Skills digital toolkit.

2. Overview of ESCO:

ESCO is the multilingual European classification of skills, competences, qualifications, and occupations and is part of the Europe 2020 Strategy. The classification serves as a dictionary for key skills and occupations relevant to the European labour and education market. It was launched by the European Commission services in 2010 through an open stakeholder consultation. Available in 28 languages, ESCO v1 provides a useful framework for aligning the education system with industry needs by describing the skills and competencies required for each occupation.

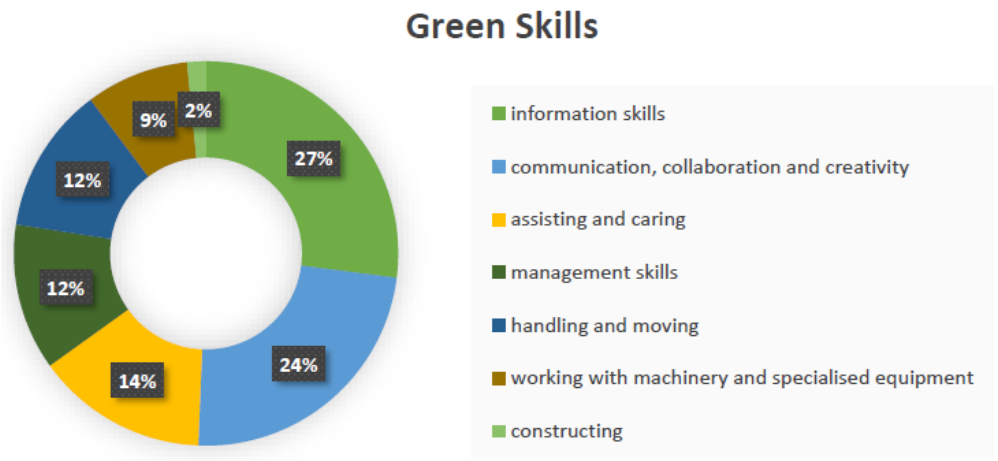
Occupations are divided into 10 categories with subcategories, and the section on qualifications includes 13485 different concepts structured in a hierarchy with subcategories. In addition, each concept also includes an explanation in the form of a description. In relation to each subcategory, each concept targets a different type of knowledge or skill/competency that exists:

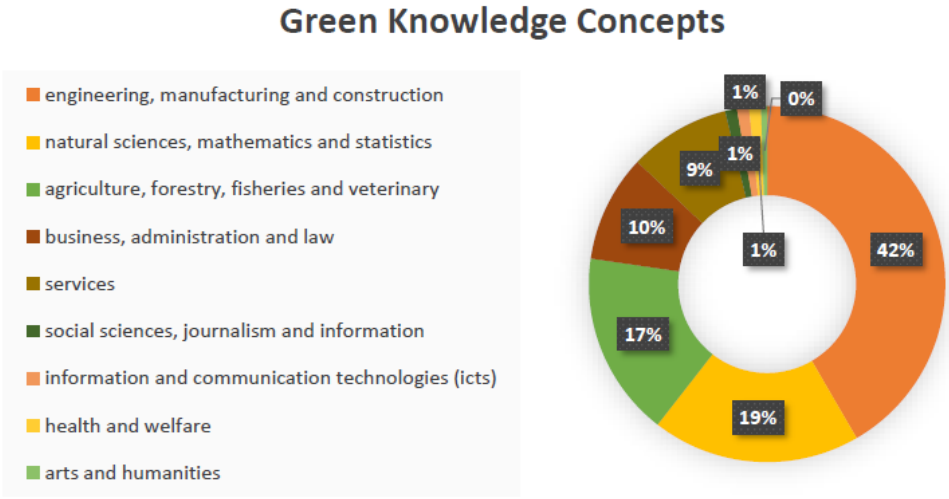
- Knowledge
- Skills
- Attitudes and values
- Language skills and knowledge

The ESCO qualification hierarchy is a continuous process of improvement. Since 2022, this classification also includes 3 categories that identify the capabilities according to their impact on the environment, available on the Labeling ESCO classification page:

- **Brown skills:** those increasing the negative impact of human activity on the environment, as "production of electricity by using coal."
- **White skills**: including knowledge and skills that don't increase nor reduce this negative impact in the environment, as for example: software performance".
- **Green skills**: all the skills that help protecting the environment by reducing the negative impact of human activity on the environment, as "cogeneration of heat or cold power from geothermal energy". Meanwhile some examples of green knowledge are engineering, manufacturing, construction, or natural sciences.

A total of 571 ESCO skills and knowledge concepts are identified as green. The charts below (ESCO, 2022) show the distribution of green concepts in the skill, knowledge, and transversal skill hierarchies.







3. Overview of SKILLSEA

The SKILLSEA blueprint Project is led by the social partners of the maritime industry, the European Community Shipowners' Association (ECSA) and the European Transport Workers' Federation (ETF), and consists of a consortium of national maritime authorities, shipping companies, shipowners' associations, maritime trade unions and maritime education providers from 16 countries in Europe.

The project analyses how technological developments in the maritime industry will affect the skill requirements for workers of the future. New educational packages have been created to support the adaptation of the educational system to the new needs and trends.

The first is aimed at maritime professionals (at operational and management levels) interested in energy-efficient and environmentally friendly ship operations and includes

12 lessons of 3 hours each. The lessons are available in English and the topics are (those marked with * are available as examples only):

Lesson	Topic
1.	Alternative fuels*
2.	Green legislation in an operational context*
3.	Determining environmental impact
4.	Climate change and the adaptation of transport infrastructure
5.	Energy-efficient operation – power production*
6.	Energy-efficient operation – power consumption*
7.	Energy-efficient operation – energy efficiency awareness*
8.	Data collection and interpretation, I
9.	Data collection and interpretation II
10.	Management of operation in a green context
11.	Improving green performance in an operational context
12.	Introduction to assessment case and methodology

A second Green Skills package is for ambitious deck or engine officers who want to transfer from sea to shore or have already made that transfer and want to take on duties that include Green Skills. The duration of the entire package is 40 hours of guided learning (contact) and 85 hours of self-study for a total workload of 125 hours. The course consists of five main learning streams as core elements:

1. Data Processing
2. Calculation and documentation of emissions
3. Vessel performance management systems
4. The role, design, and validation of Key Performance Indicators (KPIs)
5. The development of regulation and political structures in the maritime industry

4. Overview of MATES

The MATES blueprint project developed a skills strategy for maritime technologies, in particularly shipbuilding and offshore renewable energies. MATES undertook a collaborative approach to better align educational opportunities and labour market needs in all European sea basins, increasing the attractiveness of maritime careers.

Furthermore, the project aimed to broaden the perception of ocean literacy initiatives from an industry perspective.

The project provided an opportunity to contribute to updating ESCO by feeding the database with expected new profiles in the Shipbuilding (SB) and Offshore Renewable Energy (ORE) sectors and updating ESCO descriptors for existing occupations in these sectors. This work was based on the results of the analysis of current skills gaps[1] and the foresight of future skills needs[2]. Two of the identified future trends are expected to have a stronger impact on the demand for green skills for the maritime technologies: the exploitation of alternative fuels and the green retrofitting of vessels.

The exploitation of alternative fuels also includes renewable energy sources, methanol, liquefied biogas, hydrogen…The main professions affected by this trend are: Marine Engineer, Naval Architect, Naval Architect, Marine Engineer and Marine Mechanical Engineer. As a result of this trend, a new occupation has been identified and described: Alternative Fuels Engineer.

A set of 16 skills and knowledge were assigned to these occupations to facilitate their adaptation to the new scenario (the skills and knowledge marked in green were classified as green skills and knowledge in 2022):

Skills:
Analyze energy consumption.
Conduct energy audit.
Develop energy saving concepts.
Identify energy needs.
Operate battery test equipment.
Promote innovative infrastructure design.
Promote sustainable energy.

Knowledge:
Energy efficiency.
Battery chemistry.
Battery components.
Battery fluids.
Chemical products.
Fuel gas.
Renewable energy technologies.
Solar energy.
Vessel fuels

Green retrofitting is an upgrade of an existing structure to improve energy and environmental performance. The three occupations most affected by this trend are: Marine engineer, Naval architect, and Marine engineering technician.

A set of 10 skills and knowledge have been matched to these occupations to facilitate their adaptation to the new scenario (those marked in green have been classified as green skills and knowledges in 2022):

Skills:
Assess environmental impact.
Develop waste management processes.
Ensure compliance with environmental legislation.
Integrate new products in manufacturing.
Promote innovative infrastructure design.
Promote sustainable energy.

[1] Sdoukopoulos, E., Tsafonias, G., Perra, V.M., Boile, M., 2020. Baseline Report on present skills needs in shipbuilding and offshore renewables value chains, MATES project results. projectmates.eu/wp-content/uploads/2020/10/MATES_D2.1_Final_Oct-2020.pdf

[2] Ergas I., Smyrnakis G. (2020). Foresight scenarios identifying future skills needs and trends. Results of the MATES project projectmates.eu/wp-content/uploads/2021/01/MATES-D2.3-Foresight-scenarios-Jan-2020.pdf

Knowledge:
Composite materials.
Energy efficiency.
Environmental legislation.
Renewable energy technologies.

SECTION 3: TOOLKIT WIREFRAME – GREEN DIVING CLASS PLAN AND PROJECT/CHALLENGES

1. Competencies presented on the Toolkit

Competence/ Skill	Brief Description	Duration	NOTES	Related courses at the school
3.1. Impact of Litter in Natural Environments	This skill relates to understanding of ecological consequences of various anthropogenic wastes and raising awareness regarding the protection of the environment and marine ecosystem from pollution.	2h	BBZ-NOK (author)	Part of the overall curriculum
3.2. Alternative Fishing Gears	Know the principles of sustainable fishing and understand the importance of practice of this economic activity with responsibility. In addition, be aware of the biological characteristics of selected fish species to understand the selectivity of different fishing methods.	2h	BBZ-NOK (author)	Part of the overall curriculum
3.3. Microplastics in Maritime Areas	Learn about the classification and types of microplastics. Explain the process of microplastics formation. Implement microplastics possible mitigation procedures.	2h	Latvian academy (author)	Environmental protection course in maritime schools
3.4. Raising awareness on sustainability	Get to know how bad habits and practices in the maritime sector affect the environment by highlighting bad practices in the maritime sector to raise awareness and avoid them.	3h	COROSO (author) .	Courses in composite materials, timber, electrical and mechanical maintenance
3.5. Impact of boatbuilding materials	How shipbuilding materials impact the marine system, focusing on oil as a	3h	COROSO (author)	Courses in composite materials, timber,

	hazardous waste type. Learn how to implement waste handling procedures for changing oil in outboard and inboard engines to prevent pollution.			electric and mechanical maintenance
3.6. Waste management (a t workshop)	Promote awareness on the importance of a proper waste management system in a workshop. Learn how to better manage the various types of waste generated during boat construction with the materials most used in recreational boat construction and repair: Composites, wood, nets, electrical and mechanical equipment, rubber, and sails.	3h	CETMAR (author)	Courses in composite materials, timber, nets, electric and mechanical engineering, inflatable rubber repairs and sails
3.7. Ocean Literacy (Seven principles)	Promote understanding and appreciation of the ocean and its impact on our planet. Provide a comprehensive overview of the seven principles of ocean literacy. To help participants become informed and feel responsible for the protection of marine environment. Throughout the course, participants will discuss a variety of topics including marine ecosystems, ocean dynamics, human interaction with the ocean, and the importance of ocean exploration, conservation and sustainability.	3h	Escola do Mar dos Açores	Courses in marine biology, oceanography, marine conservation, coastal management, environmental science, ocean policy and governance, sustainable fisheries
3.8. How to reduce Footprint in training and in real life: good practices	Equip learners with practical knowledge and skills to minimize their environmental footprint both in their professional training and in their daily lives. Assist in understanding the concept of ecological footprint, its	3h	Escola do Mar dos Açores	Sustainability studies, environmental management, green building and design, waste management and recycling, renewable energy

	impact on the environment, and the importance of adopting sustainable practices. Explore a wide range of topics including energy conservation, waste management, sustainable transportation, responsible consumption, and the promotion of biodiversity. Through interactive lectures, case studies, and group discussions, help participants gain insight into best practices for reducing their environmental impact and promoting sustainability in both educational and everyday situations.			systems; sustainable transportation, sustainable agriculture

2. Impact of litter in natural environments

Introduction to the competence/skill (1-3 pages)

This lesson is part of a longer teaching unit (about 20h) on marine litter. At the beginning of the unit, a field trip to a nearby beach is conducted. Together with rangers from the Wadden Sea National Park, the students collect all the trash particles on the beach and then bring them to a laboratory. There, under the guidance of the rangers, the students examine the garbage they have found. It is quantified, determined, analysed, and entered forms according to the OSPAR monitoring standards.

Back in the classroom, different aspects of marine litter are explored in more depth. First, possible sources of the different types of litter are collected. Subsequently, students are made aware of the consequences of litter for the Wadden Sea ecosystem and the marine ecosystem in general. At this point it is better to start with the teaching unit presented here. After the students have learned about the sources of waste and the effects of waste, they are supposed to reflect on their own behaviour about waste prevention in the final step. Advanced students should also develop ideas on how to make the acquired knowledge accessible to a wider audience (e.g., fishermen, sailors, etc.).

Age	15-25 years old
Duration	3h

Learning outcomes	• Knowledge about the different types of waste. • Awareness about the importance of not polluting nature with garbage.
Resources	https://www.nationalpark-wattenmeer.de https://www.ospar.org/
Activities Steps	**Introduction** The teacher introduces the topic: a powerful introduction to the topic is achieved through various images of marine life in connection with garbage. To name just a few: • Stomachs of starving birds full of garbage. • Dead animals in ghost nets. • Animals trapped in various plastic structures. Such images inevitably cause consternation and create a high level of motivation to deal with this topic. Of course, the selected examples do not depict the entire problem, but they do attract a great deal of attention due to their forcefulness. Since the students have also experienced first-hand how much trash accumulates on the beach, they should be clearly aware of the extent of the problem by now. **Main activity:** Students are given cards with pictures. They show different animals, ecosystems, and types of waste. The students' task is to work in groups to make meaningful assignments. The effects of the respective type of waste on the ecosystem or animal are to be named. After this work phase, the respective groups prepare short presentations. **Discussion and conclusion** At the end of the lesson, students should be able to name the effects of specific types of waste on specific marine organisms. This will be achieved through short presentations by the students (pictures, graphs, texts will be provided to the students). Each group of students will focus on a different type of waste. Finally, an evaluation is done through an online quiz (Kahoot, Quizizz, Mentimeter, Socrative, etc.).
Tips	The organisers provide some media materials, including posters. You can print the poster before lesson.

3. Alternative fishing gears:

Introduction to the competence/skill (1-3 pages)

A fishery will always have an impact on the marine environment, but we can try to minimize that impact as much as possible. At the same time, fisheries must be sustainable not only ecologically but also economically. Technical innovations play a prominent role in this.
For students in the fisheries sector, it is very important to evaluate the impact of their fishing gear on the environment. This issue is also becoming increasingly important for students who are not directly involved in fisheries. As consumers, they also have a responsibility to support sustainable fisheries.

Age	15-25 years old
Duration	3 h
Learning outcomes	• Acquire high quality information on marine environmental issues and solutions specific to the context of sustainable fisheries. • Make more sustainable decisions in daily fishing practices. • Learn that more fishing does not equal better.
Resources	https://www.thuenen.de/en/institutes/baltic-sea-fisheries/fields-of-activity/research/fisheries-and-survey-technology https://www.thuenen.de/en/institutes/sea-fisheries https://www.geomar.de/en/
Activities Steps	**Introduction** The teacher introduces the topic through various pictures of different fishing vessels and gear. Prominent examples include: • Artisanal octopus-fishery with pots • MSC certified hand fishing for yellowfin tuna • Large pelagic freezers (Tuna or similar) Introductory question: what is the difference between the fishing methods presented? Short highlight-answer session (each student says one word that comes to mind). Guidance: different fishing methods have different impacts on the marine ecosystem. **Main activity** Students are given a stack of cards with pictures showing different fishing methods, fishing gear, and fishing vessels. In another pile are text cards with various advantages and disadvantages (fuel consumption, bottom contact, ecological impact, cost, technical requirements in terms of vessel size and equipment, labour required,

	selectivity/bycatch in terms of species, size, shape, and behaviour). Students are tasked with working in groups to make meaningful classifications. The effects of the use of the respective fishing gear on the ecosystem as well as on the economic situation of the fishermen are to be named. After this work phase, the respective groups prepare short presentations. **Discussion and conclusion** By the end of the lesson, students should be able to name the impacts of specific types of fishing gear on specific marine ecosystems and on the economic situation of fishermen. This will be accomplished through short student presentations (pictures, graphs, text will be provided to students). Each group of students will focus on a different type of fishing gear. Evaluation is done through test, group projects, case studies, presentations, field reports, online quizzes (Kahoot, Quizizz, Mentimeter, Socrative, etc.)
Tips	The organisers will provide some media materials, including posters. You can print the poster before the lesson.

4. Microplastics in marine environments

Introduction to the competence/skill (1-3 pages)	
The main idea of the competency related to the course 'Microplastics in marine environments' involves the student's ability to classify and identify microplastics and their origin. After gaining initial competency in distinguishing different types and classes of microplastics, students can move further into the process of microplastic formation. Once students have acquired the above skills, they can think about how to mitigate the spread of microplastics in the marine environment.	
Age	15-25 years old
Duration	3 h
Learning outcomes	• Ability to understand and identify microplastics in the marine environment. • Understand and know the origin, formation and classification of microplastics.

- Be familiar with possible methods mitigate microplastics in the marine environment.

Resources

YouTube videos:

- https://www.youtube.com/watch?v=ZHCgA-n5wRw (brief introduction into microplastics)
- https://www.youtube.com/watch?v=49OJoTsZYO0 (what is microplastic?)
- https://www.youtube.com/watch?v=ZZHmIGNXaSk (guide to microplastics analysis)
- https://www.youtube.com/watch?v=GhZ_XicFuyY (microplastics: knowns, unknowns and acions)
- https://youtu.be/1PlK9oGQvzA (documentary – how dangerous are microplastics?

Web JCF:
What are microplastics?

- https://www.nature.com/articles/d41586-021-01143-3
- https://www.britannica.com/technology/microplastic
- https://education.nationalgeographic.org/resource/microplastics
- https://www.clientearth.org/latest/latest-updates/news/microplastics-what-are-they-and-why-are-they-a-problem/

Possible solution to the problem of microplastics

- https://education.nationalgeographic.org/resource/microplastics
- https://oceanservice.noaa.gov/facts/microplastics.html
- https://www.britannica.com/technology/microplastic

https://www.greenmatters.com/p/microplastics-solutions

Microplastics Classification

- https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7920964/
- https://education.nationalgeographic.org/resource/microplastics
- https://specac.com/explain-difference-between-ftir-ir-and-atr/
- https://sciencesolutions.wiley.com/wp-content/uploads/2021/10/KnowItAll_Microplastic_Classification_Whitepaper.pdf

Origin of Microplastics in the Marine industry

- https://www.sciencedirect.com/science/article/pii/S0048969721052323
- https://pubs.acs.org/doi/full/10.1021/acs.est.1c05446#
- https://pubs.acs.org/doi/full/10.1021/acs.est.0c04522

Activities Steps

Introduction

The teacher introduces the topic and explains what microplastics are by saying: '' People use plastic products every day, and they are an integral part of modern life. Despite the wide range of plastic applications, most of it is used only temporarily and soon becomes waste that must be treated somehow.
Plastic itself can take hundreds or thousands of years to decompose, but it is capable of breaking down into smaller particles. Particles that are less than five

millimetres in diameter are called microplastics. Some of these form when a larger piece of plastic is exposed to sunlight, ocean waves or wind abrasion, while others can also be intentionally manufactured to make detergents, pesticides, diapers, medicines, cosmetics and other widely used everyday products. In addition to the main components of microplastics - carbon and hydrogen - they also consist of additives. If microplastics get into the environment, it is almost impossible to get rid of them. Due to its small size, microplastics can be found in the air, in water, and especially in living organisms.

Scientists have found microplastics in birds, mammals and more than 114 aquatic species that are particularly sensitive to them. When ingested by small organisms, it interferes with their adequate food intake and promotes the development of neurological and reproductive toxicities. Microplastics have also been detected in human tissues and organs, but the implications of these findings are uncertain. Although the effects of microplastics on the environment and humans are still in the research stage, the evidence to date indicates that there is a need to reduce its presence in nature. Nanoplastics can be mentioned as one of the examples. It is the other known decomposition stage of microplastics. Recent studies have shown that nanoplastics can penetrate the cells of organisms and promote their mutations, triggering carcinogenic diseases and slowing down their development.

Microplastics can be categorised by origin, type of material, size and shape. To name just a few:

According to origin, there are two categories of microplastics: primary and secondary microplastics.

According to the type of material determined by infrared spectroscopy, there are: polyethylene, polyacrylate, polyamide, polycarbonate, polypropylene, polystyrene, polyvinyl chloride, chlorinated polyvinyl chloride or polyester.

According to size and shape, the following shapes were identified using the SVM (Support Vector Machine): fibbers, films, fragments, and beads.

Main activity

Discuss in groups a possible solution to the microplastics problem.

Steps:

Divide students into groups and give them time to think about possible solutions to the problems.

Solutions:

Ban single use plastic

In the 2000s, the first legal regulations aimed at reducing the use of single-use plastic appeared.

In China, imports and free distribution of packages were banned, but their production and sale were not limited. Only plastic bags smaller than 50 microns (0.05 millimeters) thick were banned or taxed in France, India, Italy, and Madagascar. Other single-use plastic items were restricted in 27 countries.

Nonetheless, the volume of plastic pollution has increased rather than diminished during the last 20 years. Such half-measures were clearly insufficient. Rwanda's government set a bold example: in 2019, it became one of the first countries in the world to completely ban the production, import, use, and sale of all single-use plastic products, including packaging, containers, and bottles, as well as folders and balloons.

In developed countries, they prefer to follow the Reduce, Reuse, recycle formula, banning the use of only plastic that cannot be efficiently collected, sorted or recycled. As a result, the EU has banned the production and use of plastic straws, plates, cutlery, cotton swabs, balloon sticks, food containers and

glasses made of non-recyclable plastic since 2021. At the same time, EU countries have committed to collecting 90% of plastic bottles by 2030 and producing 30% of new containers from recycled materials.

Removal of microplastics from food

Microplastics are deliberately added to a wide range of consumer products, from cosmetics, hygiene products and household chemicals to building materials and agricultural products. Plastic microgranules, for example, are added to shower gels, shampoos, scrubs, toothpaste, which can be completely replaced with natural biodegradable raw materials.

With every average shower, 100,000 more plastic microparticles enter the ocean. The UK alone supplies the marine environment with 86 tons of plastic microbeads every year, which are found in cosmetics and hygiene products.

The UN called for a global ban on the use of microplastic pellets in consumer products six years ago, but only 15 countries have enacted legislation so far. The United States was the first to do so in 2015: the “Plastic Microbead Free Water Act” banned the production (since July 2017) and sale (since July 2018) of cosmetic and hygiene products containing microplastics.

In 2018, the EU decided to ban the use of microplastics in cosmetics, personal care products, as well as detergents and cleaners.

Filter and disposal of microplastics at home

Recently, Canadian scientists discovered that the majority of microplastics polluting the Arctic come from typical household laundry rather than plastic rubbish. There are around 40 microplastic particles per cubic meter of ocean water. Fibers account for 92.3% of these, with polyester accounting for 73.3%. The washing of synthetic clothes is the source of these fibers, because sewage treatment plants, while unable to filter out microplastics, pass more than 20 billion of them each year to the ocean.

According to American scientists up to 30% of the microplastics that enter the oceans are separated car tire particles. They mix with road dust, enter the soil, groundwater, and atmosphere, and spread with precipitation.

A way to get rid of this source of microplastic emissions was proposed by a group of British design students. They developed a device that is attached to wheels and captures up to 60% of rubber particles. The collected microplastics are proposed to be reused in the production of dyes, soundproofing materials and in 3D printing.

Removal of microplastics from wastewater

Even the most advanced wastewater treatment plants cannot completely filter microplastics from wastewater. Moreover, some filters even split it into even smaller particles that already easily bypass any filtration systems. However, microplastics can be decomposed into carbon dioxide and water. A number of promising developments that are being tested today in the world are based on this principle.

One technology uses sunlight to decompose microplastics. Under its influence, polymers decompose into harmless components, but under natural conditions, the process takes many years. Swedish researchers have developed a filter made of nano-sized wires coated with titanium and zinc oxides. The membrane traps microplastic particles, and when exposed to sunlight, metal oxides cause them to dissolve, often speeding the natural photocatalytic oxidation of plastic.

Canadian chemists devised an alternative method: oxidation of microplastics using an electric current. Scientists added soluble electrolytes to polluted water and then passed a current through it. Under the action of electricity, the electrolyte, combined with microplastics, ensured its decomposition into water

and carbon dioxide. Within an hour of electrolysis, the content of microplastics in water was more than halved.

Discussion and conclusion

1. What are the major sources of microplastics in the maritime industry?
2. In the context of the maritime industry, how do microplastics influence marine ecosystems?
3. What are the possible risks and hazards of microplastics in the maritime industry?
4. How can the marine industry prevent microplastics pollution in the ocean? Are there regulations or guidelines to address the issue of microplastics in the maritime industry?
5. Are there alternative materials or practices in the maritime industry to minimize the use of plastics and reduce microplastic pollution?

Abrasion of rope

This study tested a variety of ropes differing in age and polymer type. The results of this study are the first to indicate that large quantities of microplastic can be formed from mechanical hauling of ropes in the maritime settings. Microplastic from rope abrasion is likely to directly infiltrate the marine environment. Microplastic fragments, not fibres, were generated from rope wear. New rope released significantly less microplastic fragments than older rope (≥ 2 yrs). Rope maintenance, replacement, and recycling criteria are required.

Grey water

An increasing number of studies are revealing high proportions of microplastic fibers in coastal waters and remote marine environments. As moving cities at sea, cruise ships with high passenger capacity generate and discharge waste streams along travel routes, making some of the ocean's remotest places hotspots for microplastics, endangering the health of marine biota and the resilience of sensitive marine ecosystems. Gray water from cruise ships can also be rich in microplastics.

Gray water refers to wastewater from laundry, galleys, washbasins, showers, and sinks, that can be directly discharged into most marine environments without further treatment under current regulations, namely Annex IV to the International Convention for the Prevention of Pollution from Ships (MARPOL) in effect since 2003. During week-long cruises, passengers use laundries more regularly, and beddings and fabrics are frequently replaced, resulting in an abundance of microplastic fibers with textile origin in gray water.

Marine coatings

The geographical load, temporal changes, and potential sources of microplastics (MPs, 1 mm) in the German Bight (North Sea, 2.5 m water depth) were investigated in this first mass-related survey. Pyrolysis, gas chromatography, mass spectrometry, and thermochemolytic were used to detect relevant plastic kinds.

Evaluation

Following strategies can be implemented to assess students: tests, written assignments, group discussions, debates, presentations regarding microplastics impact on the maritime industry, multiple choice quizzes, case studies, laboratory experiments.

Tips

The organizers supply various media materials, such as posters. The presenter can print the poster or lesson information from this file to distribute to students before the class to help them comprehend the topic; however, it

is preferable to distribute it electronically to lessen the impact on the environment.

Existing Good Practices: (3 to 5 resources)

- https://www.youtube.com/watch?v=GhZ_XicFuyY
- https://www.horiba.com/int/scientific/applications/environment/pages/microplastics/?gclid=CjwKCAiA8OmdBhAgEiwAShr40-av0QkZ-0S810-qEPGsJpfpEo6KBos7y3Mk1RICHCiqjbAc7_OcKRoCDb8QAvD_BwE
- https://tappwater.co/en/what-are-microplastics-tips-to-reduce/
- https://wasserdreinull.de/en/knowledge/microplastics/

5. Raising awareness on sustainability

Introduction to the competence / skill (1-3 pages)	

Due to the low level of boat maintenance studies and certain students' entire removal from standard educational system, many of them students will not continue their studies or even will not work in jobs related to marine studies. For all these reasons our main objective is the environmental awareness of our students. Being able to observe how plastics end up in the food chain will help the student in his professional performance to carry out boat maintenance operations with the greatest possible environmental sensitivity.

Age	15-25 years old
Duration	3 h
Learning outcomes	• Identify / observe microplastics in marine organisms. • Know the impact of microplastics on human health.
Resources	Power Point. Paper microscope. Samples to be observed.
Activities Steps	**Introduction** The teacher introduces the topic, outlining how human activities are affecting the marine ecosystem. Overfishing, urban dumping, industrial dumping, introduction of medications into the environment, destruction of ecosystems, warming of seawater, and, of course, the introduction of plastics are just a few examples. To extend information about the microplastics studied in the unit preceding the main activity, the teacher can focus on the impact those materials have on. **Main activity**

	Observation of fish and mollusks containing microplastics. The steps are as follows: prepare the materials, make a paper microscope, and examine the microplastics. The students must guess which microplastic they observe. **Discussion and conclusion** Microplastics observation questions (quizzes, assessment tests, debates & discussions, case studies, project presentations).
Tips 	Recycle all the materials used during the development of the activity.

6. Impact of building materials

Introduction to the competence / skill (1-3 pages)
Given the limited emphasis on boat maintenance courses and the presence of students who may have had limited exposure to traditional educational institutions, a substantial section of marine student body may not pursue additional study or find work directly related to maritime studies. As a result, our primary mission is to raise environmental consciousness among our students. By allowing students to see directly how plastics enter the food chain, we hope to improve their professional abilities and instill a higher level of environmental concern when doing boat maintenance procedures.

Age 	15-25 years old
Duration 	3 h
Learning outcomes	• Identification of leftover oil change residues in inboard motors • Get knowledge about the handling and recycling procedures
Resources 	Power Point Presentation. Inboard motor Oils and filters Debris accumulation area
 **Activities Steps**	**Introduction** The teacher introduces the topic: oils as a dangerous type of waste, dangerous waste management, the accumulation area, segregation of waste. Students learn about the possible dangers posed by oil waste, as well as its negative effects on ecosystems and human health. The instructor highlights the need for proper waste management and disposal to avoid pollution and contamination. **Main activity** The first step is to use a Power Point presentation to present the activity. Following that, the students and teacher must prepare all the materials for the

	practical activity, which is an inboard oil change. While the instructor records an interactive video, the students must perform this technique as directed by the teacher. Furthermore, students learn to recycle and manage waste and materials correctly throughout the process. **Discussion and conclusion** Throughout the conversation, the learners are quizzed on the procedures and methods of waste management. The recorded video will be uploaded to raise further questions about it.
Tips	Recycle all the materials used during the development of the activity.

7. Waste management

7.1. Waste management in the wooden boat manufacturing workshop

Introduction to the competence / skill (1-3 pages)

In this unit, students will expand their knowledge about the waste generated in the wooden boat manufacturing workshop. To this end, the concept of waste is reviewed first, and figures are provided on the amounts of waste generated in Europe. Showing, therefore, the importance of reducing its genesis and improving its management to achieve the sustainable development of societies. In addition, the main actions taken in waste management are explained through the well-known hierarchy of actions. Finally, the main waste generated in the workshops and what good practices can be adopted are exposed to teach students how to properly treat the waste they produce.

Age	15-25 years old
Duration	3 h
Learning outcomes	• Participate in the training center's waste reduction and management efforts. • Learn how to properly manage the various forms of waste generated throughout the wooden boat construction process.
Resources	YouTube video: How it's made: wood pellets?w it's made: wood pellets? Web JCF: Waste statistics Europe Summary of the current EU waste legislation

	Definitions Waste framework directive European List of Waste Guideline to classify waste Bridging education and business in the blue economy: best practices ans user stories. Particleboard from agricultural biomass and recycled wood waste: a review
Activities Steps	**Introduction** The instructor introduces the topic with a Power Point presentation that includes such information as: what sustainable development is, the amount of waste in Europe divided by different sectors of society, the importance of caring for it, and the hierarchy of actions to take to achieve better management (prevention, re-use, recycle, valorize, and elimination). The presentation also provides information about the many forms of waste generated during the workshop and categorizes them as dangerous or non-hazardous. Finally, the teacher discusses the workshop's best practices. **Main activity** The first step is to present the activity “Looking for My place”, which comprises of the following steps: The first step is to prepare some stickers with different types of waste generated in the workshop. After that, divide the stickers among the students and place them in the workshop. Where? In the location where the waste should be deposited. The stickers will remain in the workshop so that no one forgets where to sort through the trash. **Evaluation** The students must guess, without looking, what type of waste should go in different containers.
Tips	The stickers must be created by the students while analyzing the waste they generate.

7.2. Waste management in composites workshop

Introduction to the competence / skill (1-3 pages)

This unit further expands knowledge about waste management decisions in the composites boat production workshop. It starts by examining the concept of waste and offering statistics on European garbage generation. It then delves into the fundamental waste management tasks, such as waste reduction, reuse, recycling, and proper disposal. The emphasis is on waste management procedures that are in accordance with environmental rules and sustainability ideals.

Age	15-25 years old
Duration	3 h
Learning outcomes	• Get involved in reducing waste and improving its management in the training center. • Learn how to better manage the different types of waste produced in the composites boat building process.
Resources	YouTube video: Web JCF: Waste statistics Europe Summary of the current EU waste legislation Definitions Waste framework directive European List of Waste Guideline to classify waste Bridging education and business in the blue economy: best practices and user stories. Particleboard from agricultural biomass and recycled wood waste: a review
Activities Steps	**Introduction** The teacher introduces the topic with a Power Point presentation that includes information about sustainable development, the amount of waste in Europe divided among the various sectors of society, the importance of caring for it, and the hierarchy of actions to take to achieve better management (prevention, re-use, recycle, valorization, and elimination). The presentation also includes information regarding the many forms of waste generated during this session, as well as their classification as harmful or not dangerous. Finally, the teacher describes the workshop's best practices. **Main activity** The first step is to present the activity "Looking for My Place," which comprises of the following steps:

	The first stage is to make some stickers out of the many types of waste generated in the workplace. After that, divide the sticker among the students and place it in the workshop. Where? In the location where this rubbish should be disposed of. The stickers will remain in the workshop so that no one forgets where to sort the trash. **Evaluation** The students must guess what type of waste they need to sort in the different containers without looking.
Tips 	The stickers must be created by the students by trying to analyze the waste they generate.

7.3. Waste management in the nets and sails workshop

Introduction to the competence/skill (1-3 pages)

In this unit, students will expand their knowledge about the waste generated in the nets boat manufacturing workshop. To that goal, the idea of waste is discussed first, and numbers on the quantity of waste generated in Europe are supplied. As a result, it demonstrates the need of lowering its genesis and enhancing its management to achieve society's long-term growth. Furthermore, the essential waste management actions are explained using the well-known hierarchy of acts. Finally, the main trash generated in the workshops and what excellent practices can be used are highlighted in order to teach students how to properly manage the waste they produce.

Age 	15-25 years old
Duration 	3 h
Learning outcomes	• Get involved in reducing waste and improving its management in the training center. • Learn how to better manage the different types of waste produced in the wooden boat construction process.
Resources 	YouTube video: Web JCF: Waste statistics Europe Summary of the current EU waste legislation Definitions Waste framework directive European List of Waste

Guideline to classify waste

Bridging education and business in the blue economy: best practices and user stories.

Particleboard from agricultural biomass and recycled wood waste: a review

Activities Steps



Introduction

The teacher starts the introductory topic by using a Power Point presentation about sustainable development, amount of waste in Europe divided on the different sectors of the society, the importance of considering it, the hierarchy of actions needed to be taken to achieve better management (prevention, re-use, recycle, valorization, elimination). The presentation also includes some information about the different types of waste generated in the workshop and their classification as dangerous and not dangerous. Finally, the teacher explains the good practices in the workshop.

Main activity

The first step starts with presentation of the activity “Looking for My place”, the activity consists of:

The first step mainly starts with preparation of some stickers with different types of waste generated in the workshop. After, the instructor divides the sticker among students and pastes them in the workshop. Where? In the place that this waste should be deposited. The stickers will remain in the workshop as reminders for garbage sorting.

Evaluation

Students must guess, without looking, what kind of trash to throw in the different bins.

Extra activity

As in these workshops the amount of waste is very low, in these cases an extra activity is proposed. Which consists of the search of a local waste treatment plant to prepare its flow diagram and understand the procedure for treating urban waste, which in turn is also generated in the industrial sector. In our case, we proposed the elaboration of the treatment flow diagram of a plastics treatment plant called SOGAMA and that of a general waste plant.

Tips



The stickers must be created by the students who analyze the waste they produce.

7.4. Waste management in the mechanical workshop

Introduction to the competence/skill (1-3 pages)	
In this lesson, students will deepen their knowledge of the waste produced in the mechanical boat building workshop. For this purpose, first the term "waste" will be explained and figures about the amount of waste produced in Europe will be given. From this, it will be seen how important it is to reduce waste generation and improve waste management in order to achieve sustainable development of society. In addition, the main waste management measures are explained using the well-known hierarchy of measures. Finally, the main wastes generated in the workshops and best practices are highlighted so that students know how to properly manage the waste they produce.	
Age	15-25 years old
Duration	3 h
Learning outcomes	• Participate in reducing waste and improving waste management at the training center. • Learn how to better manage the different types of waste generated during the construction of wooden boats.
Resources	YouTube video: How it's made: wood pellets?w it's made: wood pellets? Web JCF: Waste statistics Europe Summary of the current EU waste legislation Definitions Waste framework directive European List of Waste Guideline to classify waste Bridging education and business in the blue economy: best practices and user stories. Particleboard from agricultural biomass and recycled wood waste: a review
Activities Steps	**Introduction** The teacher introduces the topic with the help of a Power Point presentation that includes information about sustainable development, the amount of waste in Europe divided among the different sectors of society, the importance of taking care of it, and the hierarchy of actions for better management (prevention, reuse, recycling, valorization, disposal). The presentation also includes some information about different types of waste generated in the workshop, classifying

them as hazardous and non-hazardous. Finally, the teacher explains the best practices in the workshop.

Main activity

The first step is to present the activity “Looking for My place”, the activity consists of:

The first step is to prepare some stickers with different types of waste generated in the workshop. Then, the stickers are divided among the different students and put them in the workshop. And where? In the place where these wastes should be disposed of. The stickers remain in the workshop so as not to forget where to dispose of the waste.

Evaluation

Students must guess, without looking, what kind of trash to put in the different containers.

Tips



The stickers must be created by the students analyzing the waste they produce.

8. Ocean literacy

Introduction to the competence/skill (1-3 pages)

In this unit, students will expand their knowledge about the 7 principles of ocean literacy, which are:

1. **Earth has one big ocean with many features.**

   This principle emphasises that the ocean covers about 70% of the Earth's surface. So does the distribution of water on Earth, the water cycle, and the acidity of the oceans. The geological dynamics of the Earth are enormous, including the movements of tectonic plates, islands, trenches, mid-ocean ridges, and rift valley fractures.

2. **The ocean and life in the ocean shape the features of Earth.**

   Many of Earth's materials and biogeochemical cycles originated in the ocean, including the sedimentary rocks found on land today, which were formed in the ocean (rock cycle). In addition, the ocean is the largest reservoir of rapidly changing carbon on Earth, which has increased due to the increasing use of fossil fuels and effects of marine organisms (shells and coral reefs).

3. **The ocean is a major influence on weather and climate.**

The ocean has a major impact on climate change because it absorbs, stores, and transports heat, carbon, and water. Heat exchange between the ocean and atmosphere can lead to

dramatic global and regional weather phenomena that affect precipitation patterns and drought. Some examples of such interactions are El Niño and El Niña.

Changes in these dynamics have led to climate changes over the past 50,000 years.

4. The ocean makes Earth habitable.

The ocean is responsible for more than 50% of the oxygen produced on Earth from the activities of photosynthetic organisms, making the ocean critical to the development and maintenance of life on land.

The Greenhouse effect is also a very important issue, as it is responsible for the atmosphere trapping heat and keeping the planet at a temperature that makes it habitable. On the other hand, due to the increase of pollutants produced by man, this effect has increased in such a way that the temperature on Earth is rising faster and faster, affecting life on the planet in various ways.

5. The ocean supports a great diversity of life and ecosystems.

The ocean provides a vast living space with diverse and unique ecosystems from the surface through the water column down to the seafloor. All these features contribute to the distribution of different species in different habitats, migration, life cycle and food chain.

6. The ocean and humans are inextricably interconnected.

Humans have a complex relationship with the ocean. The ocean influences and supports human life in many ways. Since ancient times, humans have used the ocean as a resource, primarily for food and transportation. However, this exploitation has been far from sustainable, and the health of the oceans has been severely compromised by overfishing and unsustainable handling of waste on board.

7. The ocean is largely unexplored.

The ocean is the largest unexplored place on Earth, only about 5% of which has been explored and mapped because it is difficult for humans to access. The high pressure in the deep ocean makes exploration of this environment extremely difficult. Therefore, ocean exploration relies on high technology and scientific researchers around the world who are constantly trying to cover more ocean areas, data and footage to learn more about and discover what lies beneath the oceans.

Age	15-25 years old
Duration	3 h

Learning outcomes	• Understand the dynamics of the oceans and their importance to the entire biosphere. • Increase environmental awareness of ocean health.
Resources	YouTube video: https://www.youtube.com/watch?v=y-aGjNdWuQk https://www.youtube.com/watch?v=EGQaSd0yixw&list=RDy-aGjNdWuQk&start_radio=1 https://www.youtube.com/watch?v=WtD72s26UDw https://www.youtube.com/watch?v=vtvfKMXmV6w https://www.youtube.com/watch?v=0Xf1fJYy-LE https://www.youtube.com/watch?v=AZrWwuEhjDw https://www.youtube.com/watch?v=y0XgfVyZ9zw
Activities Steps	**Introduction** The teacher mainly uses PowerPoint to teach and introduce the ecuational content. **Main activity** Human actions VS impact on the environment **Objective of the activity:** Learn how different behaviours/actions affect the ocean dynamics and health. **Summary of the Activity:** This activity introduces various human activities such as fossil fuel use, poor waste management (both on land and in the ocean), use of single-use plastic items, etc. Students must relate these actions to the impact on the marine environment (ocean acidification, waste accumulation, chemical pollution) and the consequences. **Step 1-** Forming groups of 2-3 people. **Step 2-** Giving the students a task of connecting the actions to the impacts and do a little research on the impacts. No longer than 15-20 minutes. **Discussion and conclusion** Groups should share their findings with the class and discuss their different conclusions and information they found during the research. **Evaluation**

An individual multiple-choice quiz.

Tips



Existing best practices:

- Reduce waste by throwing away less.
- Reduce pollutants by using non-toxic chemicals and properly disposing of all chemicals used.
- Fish responsibly, reducing bycatch and keeping more fish alive.
- Conserve water by using less avoiding runoff and wastewater.
- Reduce pollution from vehicles, avoid excessive use of fossil fuels.

8. How to reduce footprint in training and in real life: best practices

Introduction to the competence / skill (1-3 pages)

In this unit, students will learn about the ecological footprint, which measures the use of global natural resources by a person, group of people, or company. To measure an ecological footprint, we need to consider 6 criteria: Arable land, pastureland, fishing grounds, forest products, carbon, and the footprint of built-up areas. The main question is: How much of the planet's biological capacity is taken up by a given human activity or population?

Biocapacity: this is, in short, the world's ability to regenerate resources and absorb carbon dioxide emissions in a finite period. It has increased over time as yields have increased due to increasingly intensive agricultural practices. In addition, the ONU datasets used to calculate national footprint and biocapacity do not account for certain factors that reduce biocapacity (groundwater loss, soil degradation and reduced forest productivity).

How is the Ecological Footprint of a person calculated?

Calculating the Ecological Footprint is quite simple: you just need to determine the impact of your food, your home, your goods, your services, your transportation, etc. on the planet. Nowadays there are several websites where we can calculate our own ecological footprint to better understand how we affect the environment with our lifestyle and how we can improve it.

Ways of Reducing the Ecological Footprint

Reduce single-use, disposable plastic products. Plastic shopping bags, straws, cups, plastic containers and others that are used for minutes at a time and spend years rotting in the environment and breaking down into small pieces, impacting the entire ecosystem. Switching

from these items to reusable ones is a first step to reduce the use of plastic products and their accumulation.

1. **Switching to renewable energy.** The energy sector is the largest source of greenhouse gas emissions in the United States. Renewable energy sources such as solar are simple, affordable, and reduce gas emissions to the atmosphere. They are supported by several programs that make this transition possible and affordable for most people.
2. **Eating less meat.** Meat is the main source of greenhouse gas emissions, along with other issues like animal welfare. It's preferable to enjoy other dietary options such as vegetarian meals.
3. **Reducing waste and recycling.** Recycling, reducing, and reusing products help reduce the amount of waste, thereby reducing air and water pollution.
4. **Driving less.** Car use releases many pollutants into the air and ocean. If you drive less and use other forms of transportation, such as biking, walking, and public transportation, gas emissions will decrease.
5. **Reducing water waste.** Water is precious, and if you manage to reduce water consumption by using economical techniques in your home, you can avoid the unnecessary use of taps.
6. **Supporting local business.** When you support local businesses, you reduce your environmental footprint by reducing the transportation of clothing, food or supplies to their destination.

Age	15-25 years old
Duration	3 h
Learning outcomes	• Understand the environmental impact that simple daily activities and choices can have in the long term. • Introduce simple changes that can permanently reduce the ecological footprint.
Resources	YouTube video: https://www.youtube.com/watch?v=fACkb2u1ULY Web JCF: https://www.footprintcalculator.org/home/en
	Introduction The instructor mainly uses PowerPoint for teaching and introducing the

Activities Steps	educational content. **Main activity** Calculating Ecological Footprint **Objective of the activity:** Learn what is ecological footprint and how to reduce it. **Summary of the Activity:** This activity consists in calculating each individual's Ecological Footprint **Step 1-** Each student calculates his own ecological footprint with the link on the “resources” category. **Step 2-** After receiving the results of ecological footprint, students form groups of 3 or 4 and discuss how each of them can reduce their own footprint by changing some habits in everyday life. **Discussion and conclusion.** Each group will share their findings with the whole class to compare and improve methods of reducing and making better useof the resources nature gives us. **Evaluation** An individual multiple-choice quiz
Tips	

SECTION 4: GUIDING MATERIALS TO ATTRACT STUDENTS TO BLUE CAREERS

1. Introduction to the importance of attracting VET students

Many people do not know that the maritime industry is one of the key logistics industries in the world and that there are many career opportunities in this industry. According to the 2021 Seafarer Workforce Report released by the International Chamber of Shipping and the Baltic and International Maritime Council the demand for seafarers is currently estimated at about 1.45 million, including about 790,500 officers. On the supply side, there is a shortage of about 16,500 officers, while the surplus is estimated at about 119,000 seafarers.
Therefore, it is crucial to attract new students to the profession of maritime officers on ships.
Moreover, after VET, one can start a career in a stable work environment and receive an attractive salary, which is usually higher than in the general working industries. Therefore, the whole process of VET brings sustainable job opportunities and benefits to the country of marine officer's residence. Some of the maritime professions also offer other unique benefits, such as the opportunity to work with the global merchant fleet and to travel frequently by air, visiting countries around the world. At the same time, it is challenging to work with multinational crews and overcome cultural barriers.

2. Tips and Recommendations

Depending on the budget, to run advertising campaigns as the school enrollment date approaches.
To negotiate support for the maritime industry - port authorities, shipowners, insurance companies, crewing companies and other parties associated with the industry.
Organize a "summer school," i.e., the training center can introduce maritime topics, facilities, and the learning environment to younger students who may choose to get education and training in the maritime industry.
Cooperate with other training centers and educational institutions and support each other. Be competitive in a good way.

3. Best practices

Maritime career events. In the Netherlands, for example, “Navingo career event" is organized- https://www.navingocareer.com/en/career-event/ . "Navingo career event" is aimed at students, but professionals in the maritime field can also participate.
In Latvia, a career event "Enkurs" for middle school students is organized every year by the Latvian Maritime Administration https://www.lja.lv/index.php/par-mums/enkurs .
There is also another educational exhibition called: "School", where all schools provide information regarding study opportunities in different industries, including the maritime industry, https://www.bt1.lv/skola/ .

There is also the possibility of organizing open door events in the maritime schools to present to all the interested parties and stakeholders the subjects presented, as well as facilities and available learning equipment.

SECTION 5: BIBLIOGRAPHY

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Green Skills and Knowledge Concepts: Labelling the ESCO classification
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