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The Digital Blue Carrier for a Post-Carbon Future - Curriculum Innovations in Aquaculture [DiBluCa]”

WP2A2- Elaboration of Pedagogical methodology for education

*Elaborated by
Odesa National University of Technology
co all partners*



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Summary

The DiBluCa Project aims to improve higher education in aquaculture and fisheries. The COVID-19 and war in Ukraine crisis emphasized the value of digital education in Europe; DiBluCa aims to train skilled technical staff for this sector and will provide innovative curricula in HE institutions on the sustainability of water resources and footprint, fisheries now and in the future, ensure a sustainable industry and long-term employment.

The DiBluCa project will be carried out in four phases: design, localize, and modify curriculum and learning materials. There are planned transnational workshops, shops, and a digital portal with modules for user-friendly e-learning and best practices. The innovative guidebook for aquaculture higher education against global warming will be printed in English; an e-book will be accessible in the languages of all project partners.

The results of the project include: adapted HE and training programmes for future aquaculture demands, long-term employment for aquaculturists, rising numbers of university students, changing attitudes and trends, enhancement of academics and teachers aquaculture education knowledge and skills, creation of complex educational materials, integration of the digital platform with national workshop(s) and guidelines, Handbook and Interactive E-book, International conference and multiplier events.

The goals of our DiBluCa Project say that "Horizontal: Environment and fight against climate change" is one of the most critical horizontal or sectoral priorities. The DiBluCa project is all about higher education in aquaculture and how it relates to global warming in all systems. Aquaculture higher education institutions (HEIs) must develop new methods and tools to help students learn the necessary skills. A critical priority is "HE: supporting higher education institutions in their cooperation with Ukrainian counterparts to respond to the war in Ukraine." The European aquaculture sector needs specific education to adapt to climate change, help Ukraine join the European Union, and deal with the effects of war. The European aquaculture industry's tendencies will directly impact the European and Ukrainian labour markets because technological progress is the main reason for the industry's diversification, and a highly trained and specialized workforce is needed.

The trend toward more automation, specialization in production processes, and more extensive production units has made more people want to hire experts. Specialists are also needed in selective breeding and species shifts, bioengineering, biotechnology, fish biology, environmental concerns, fish health, HACCP, and food quality assurance systems.

Based on the goals of our project, "HE: Supporting digital and green capabilities of the higher education sector" is the priority. COVID-19 has raised the relevance of digital education for Europe's digital transformation. It stressed how important it is for everyone to learn how to use technology and to use technology to teach and learn. The program aims to help students, teachers, youth workers, young people, and organizations become more digital. The DiBluCa Project will use open educational resources (OER), e-learning courses, and Microsoft Teams to focus on aquaculture, the environment, and climate change. So, the program will be an important way to improve knowledge, skills, and attitudes about climate change and sustainable development inside and outside the EU. The Erasmus+ program prioritizes rural development (sustainable farming, management of natural resources, soil protection, and bio-agriculture) since the environment and global warming became a horizontal concern for project selection. The focus is also meant to help the organizations taking part in their plans for environmental sustainability. The objective is to preserve resources and eat well.

The theme of the DiBluCa project is a novel. Global warming and its impact on aquaculture are severe



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concerns in Europe. A new aquaculture and global warming curriculum would help students and professors in aquaculture engineering and associated subjects. This curriculum and e-learning platform would benefit instructors, students, and academics. The initiative will collect data from students, aquaculturists, and specialists in each partner country to generate instructional training materials. Because of new technologies, the aquaculture industry and the diversification of education need workers with many skills and training. To meet these needs, education needs to be more flexible regarding what it teaches and how it is set up (regarding accreditation and recognition). This project will create a new curriculum for higher education in aquaculture. Because the curriculum at partner universities is accredited, students can move around and study in other countries. The project will also set up shared masters and doctoral programs in aquaculture education.

The DiBluCa project will come up with a new way to fight global warming, and it will also be the best way to teach people in Europe about changing conditions in aquaculture production.

It is crucial for any activity that a high degree of uniformity be maintained at all times. This affects all of the other businesses, including the industry of aquaculture. Throughout the project, the following groups of people will, in a variety of different ways, be the focus of our attention: There will be representatives from the aquaculture industry and their technical staff, as well as fish farmers, officials from the government, and other professionals in the area of the project. In addition to that, there will be students and teachers present. It is necessary to have a well-coordinated chain of innovation to guarantee that newly developed technological strategies will eventually reach the people who utilise technology. In addition, the policymakers who are the focus of this discussion will be able to contribute to reducing the time it takes for new knowledge and technologies to be introduced to the market and put into use.

Academicians and lecturers in aquaculture education have limited access to knowledge about the effect of climatic changes and overfishing on the future of the aquaculture sector, aquaculture higher education to meet the needs of changing aquaculture systems with new trends against global warming, and professional training and courses. Specific education needs exist for the European fisheries and aquaculture sectors. The European fisheries and aquaculture industry trends directly affect the European labour market. The main reason why the industry is changing is because of new technologies. This means the sector must train a highly skilled and specialized workforce. This means an employer can quickly determine if a recent graduate is qualified for a job, no matter where or what they studied in Europe. Input from all stakeholders is essential to ensuring our future workforce has the skills required for a sustainable, successful, and thriving global aquaculture sector. All partners will support the accreditation of courses under the ECTS and/or the ECTS for Higher Education. They will also try to impact other European and developing countries through their networks. The expected impact for participants and participating organizations are the improvement of skills, competencies, and networks for implementing their activities and projects related to aquaculture education against global warming, which will be necessary for partner countries and Europe. The most significant direct effect on the target group, which comprises academics/lecturers, college students, and other interested parties, is that they learn more about the new trends in aquaculture education to fight global warming. The impact of this unique educational curriculum will be an increased awareness of aquaculture education systems.

This output has been prepared to define, describe and decisively influence the training materials foreseen in the DiBluCa project. Odesa National University of Technology (ONUT, UA) coordinates the activity on the development of pedagogical methodology in the context of objective A2 - Elaboration of pedagogical methodology for education WP n°2 - Complex training material with innovative curricula for higher education with participation of other partners in terms of responsibility for national content and



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development. Pedagogical methodology for innovative aquaculture curriculum will be developed based on the Compendium workshops for the state-of-the-art information and will allow achieving Objective 2. The teaching methodology of renewed aquaculture curriculum for HE stud, academician staff/lecturers and the sector will be described. There is no curriculum for aquaculture against global warming and overfishing in any EU member countries for HE.

ONUT and all partners will coordinate/participate in these activities for the development of the pedagogical methodology and for national content and development. The training activities carried out are designed to ensure the relevance of the materials developed, to match stakeholders' opinions and to take action to create a critical mass within the DiBluCa training system. The learning methodology is a combination of modules developed for the open online platform and MS Teams application, which aims to help partners, institutional and other stakeholders to implement digital online learning as part of DiBluCa's development and offer access to a directory of information and learning activities.

Chapter 1, Introduction defines the topic of this paper in further depth, how the training activities will be constructed, and provides techniques and didactical frameworks.

Chapter 2, User Group Selection describes the methods for identifying user groups. It describes how user groups should be chosen, who the target audience should be, and other pertinent details.

Chapter 3, The provision of training, the traits, competencies, and abilities of trainees are also outlined describes the kind of materials and documents that will be used and created throughout the training course.

Chapter 4, Modules explains the training structure, module topics, and learning criteria in further detail.

Chapter 5, Success Indicators, the different criteria used to evaluate course results via training activities are described.



Chapter 1, Introduction

Developing a training methodology involves a lot of elements. Planning and developing training in advance are necessary. The training activities help the people involved get better at their expertise and/ or interest area. The main characteristics of the DiBluCa training are:

- User-friendly, simple in appearance and initiation; possible module interconnections
- Targeted materials, feedback, and assistance;
- Perfect for adult learners, HE students and working professionals;
- Modular programme and training design customization;
- Continued guidance and assistance;
- Provide research-based, step-by-step instructions

It is essential to select the structure and methodology that will be the most effective for its training environment, considering the factors such as:

- **The overall learning objectives:** what is expected to be achieved through learning? In our case the learning materials will support transfer of know-how and innovations through acquisition of new skills and competencies of higher education students, academicians/lecturers, Fisheries and Aquaculture engineer/experts in the industry. Specialists are also needed in selective breeding and species shifts, bioengineering, biotechnology, fish biology, environmental concerns, fish health, and food quality assurance systems. The training will help students, teachers, youth workers, young people, and organizations become more digital. For this aim, existing pedagogical materials will be photos, related videos, expert teachers, and e-books.
- **Who needs the training:** what categories of trainees will increase training effectiveness and economy? In our case the training is needed by the people with the addressing the impact of climate change on aquaculture and fisheries at all stages.
- **The expected learning outcomes:** what each trained individual should be able to accomplish and know at various stages and upon completion of training? Depending on the level of training intensity and module content, trainees are expected to have knowledge of effects of global warming on water quality and impact on aquaculture and breeding, on feed and feeding in aquaculture as well as on diseases in aquaculture, of the system selection against global warming in aquaculture and defining environmental impacts of aquaculture from global warming perspective, and protective applications.
- **The range of training techniques,** including in-person meetings, the supply of reference materials, online content, and courses. Based on the results of the WP2A1 study – “To analyse the current situation in the world and partner countries on the Compendium workshops for the state-of-the-art information”, the consortium for the DiBluCa project chose online learning as a means of facilitating access to training materials.

Finally, an assessment test and user-satisfaction questionnaire will be distributed to evaluate the module’s results and its success amongst trainees.

Training objectives

Overall goal: to improve the competence of bachelors and masters from different specialisations in aquaculture and fisheries, as ‘Horizontal: Environment and Combating Climate Change’ is one of the most important horizontal or sectoral priorities. Higher aquaculture education institutions (HEIs) must develop



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new methods and tools to help students acquire the necessary skills.

All training materials should contain information useful for the target group and people involved in aquaculture and fisheries. It was emphasised that the training content should focus on modern technologies in the context of climate change impacts on aquaculture and fisheries. Module participants should have at the end of the training a solid experience in problem solving and decision making on several aspects related to the effects of increasing environmental temperature in aquaculture and fisheries as a direct result of the training activities.

The training content development is structured in 3 main phases:

- Development of a higher education curriculum on the impact of global warming on aquaculture and fisheries.
- Validations, demonstrations, adaptations
- Dissemination and Exploitation activities



Chapter 2, User Group Selection

The Need Analysis

The Needs Analysis is based on state-of-the-art national and international reports and is based on the division of work, the tasks leading to the creation of intellectual output, and the applicable methodology. These reports are based on a questionnaire designed for university students/teachers/doctoral students studying and working at the faculties of Aquaculture and Marine Sciences, Agriculture, Veterinary Medicine and Natural Sciences, Food and Agricultural Engineers, and others.

A statistical study results in a narrative report on Training Needs Analysis.

The survey included 261 respondents, including 110 academics/teachers and 151 students from 5 countries (Lithuania, Ukraine, Turkiye, Greece, Croatia). The survey of academics revealed that the vast majority (71%) of respondents were faculty members, followed by departmental/laboratory and institute staff. The level of aquaculture education provided at their university: the vast majority of aquaculture education is provided at the bachelor's (49%) and master's (37%) level, followed by doctoral level and courses. The need to have skills and knowledge on climate change and the post-carbon future for aquaculture: 91% of respondents indicated that they need skills and knowledge on climate change and a post-carbon future for aquaculture. The majority of them believe that an undergraduate curriculum on climate change and a post-carbon future for aquaculture should contain general knowledge, it can help them to be more effective in their work, it can help them to find new job opportunities and it can provide with new design and research opportunities

The survey of students revealed that 40% of respondents were from the faculties (Faculty of Ecology and Forestry, Department of Ecology, Water and Technologies of Environmental Protection; Ecology, Technologies of Environmental Protection, Technologies of Meat and Fish Products), followed by the Faculty of Aquaculture and the Marine (22%), the Faculty of Veterinary Medicine (18%), and the Faculty of Agriculture (14%). The vast majority of students are either completely (56%) or partially (34%) unfamiliar with the term Blue Carrier. However, almost all students (82%) are familiar with the terms "global warming and post-carbon future". Responses showed that most students have satisfactory knowledge of the impact of global warming on water quality, breeding and biotechnology, feeds and feeding, selection of breeding systems, environmental impacts of aquaculture and disease outbreaks, and proactive applications in aquaculture. However, only a few of them have professional knowledge, and ¼ of them have no knowledge on the subject. 90% of students emphasised that they want to have this knowledge. Almost all students believe that the development of an innovative curriculum on post-carbon aquaculture could be useful for their education. 74% believe that this innovative curriculum could increase their employability in the future aquaculture sector after graduation.

The results of the survey show the prospects of introducing a new programme in aquaculture and fisheries

The trainers/target groups

By incorporating aquaculture and fisheries knowledge and skills into the curriculum, as well as recommendations for their effective application, this project will develop and improve the advanced sources, methods and systematic skills of students enrolled in programmes in the field of the impact of global warming on aquaculture and fisheries. In this way, the initiative enhances the level of training of participants who will be significantly more resilient to crises than many other professions.



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Through the development of six modules with training courses, a virtual specialised environment with an online training package, the creation of a platform for students/scientists/teachers/experts in aquaculture and fisheries will be provided, as well as the development of a specialised innovative handbook/book in the field of global warming impacts on aquaculture and fisheries. Students, teachers, scientists, aquaculture engineers, fish farmers and fishermen, entrepreneurs, technical staff of public and private companies, policy makers and experts in the field will benefit from this project.

The beneficiaries of this project include:

- **Students:** Enrolled in programs related to aquaculture and fisheries, including undergraduate, masters, and doctoral students.
- **Academicians and Scientists:** Engaged in teaching and research in the fields of aquaculture and fisheries.
- **Aquaculture, agricultural engineers, and veterinarians:** Professionals involved in designing, implementing, and managing aquaculture systems.
- **Fish Farmers and Fishermen:** Individuals involved in the cultivation and harvesting of fish and other aquatic organisms.
- **Entrepreneurs:** Individuals interested in establishing and managing aquaculture-related businesses.
- **Technical Staff of Public institutions and Private Companies:** Individuals working in technical roles within public and private organizations involved in aquaculture and fisheries.
- **Policy Makers:** Individuals responsible for developing policies and regulations related to aquaculture and fisheries.
- **Experts in the Field:** Professionals with expertise in various aspects of aquaculture and fisheries management.

The survey found that students prefer blended learning (a combination of face-to-face and online/flexible learning) (28%), online/flexible learning based on online learning only and regular face-to-face learning on campus only (21%), and integrated learning at work (20%). However, 10% of respondents prefer independent distance learning (offline courses via the Internet).

Considering the interest shown in the questionnaire, online courses will be developed as part of the project's activities. Registration will be required, but participation will be free. It is a place for the integration of online courses, the localization of curricula and resources based on the demands of the involved partners. Each partner will organise either in-person or online training courses.



Chapter 3, The provision of training

The training materials will be developed both in national language of the partners and in English language then teaching materials will be integrated and implemented with e-learning platform.

The training materials and activities will be delivered face-to face, as well as on Virtual learning environment. The following tips might serve both as the process of assessing student understanding is, in many instances, also practice for the material; students frequently do not actually learn it until they are asked to make use of it in assessments such as these. These techniques have multiple benefits: the teacher can easily and quickly assess if learner have really mastered the material (and plan to devote more time to it, if necessary), and the process of assessing student understanding is, in many instances, also practice for the material. In conclusion, the very nature of these evaluations is what stimulates interaction, which in turn delivers several advantages. Learners are roused from the sedentary state of passively listening to a lecture, and instead become alert and interested, which are two necessary conditions for efficient learning. They usually have the impression that these methods are “fun,” even though they are frequently more effective than lectures in enabling students to learn.

Active learning

Active learning is a broad term for [a number of different ways to teach](#), all of which shift the focus from the teacher telling the students about the course material to the students doing things with the course material. It includes almost everything that students do in class besides just sitting and listening to a lecture.

This teaching method allows students to engage with the course material and with each other through structured learning activities during class time. Students won't get bored, do things that aren't on the lesson plan, or bother their classmates if there are interesting things to do in class.

The idea of "active learning" includes a wide range of ways for students to learn and interact with the course material. The goal of active learning is to encourage this kind of participation.

When students passively watch or listen to lectures – whether in person or through video – they are not actively interacting with the material. Consider the difference between your involvement with a subject and only listening to a report on it at a committee meeting and actively discussing the issue with colleagues. If students are actively engaged in the course material, they will learn more, be happier, and achieve greater achievement.

Learn about different ways to integrate active learning with this [active learning in multimodalities PDF](#).

Training activities, tools, and recourses

To meet the needs of the learner and reach the training goals, it's best to begin planning activities with the question "Why?" How I decide which digital tools will help my students learn "Backward design" means to start with the question, "What do I want my students to learn?" What would I say if I had to explain to someone why my students do these things? If we think about "why" we are doing something, we can take a step back from the result and think about tools that can help our students. Each tool should help with three main goals: getting people to learn on their own, teaching them how to learn, and making sure they know the standards. Application of a constructive alignment may support the training success. It means synchronizing pre-defined objectives, learning, and teaching activities and assessment tools. It is strongly based on active learning and student involvement. It seems to be one of today's most prominent teaching



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ideas in higher education. When developing a module/course/chapter, the teacher should be asked the following questions: What should students know or be able to accomplish following the course (what objectives do we want these students to achieve?) What learning and teaching activities should be implemented to help students develop these skills? How can we tell whether learners have properly acquired the targeted competencies?

The best place to start is with learning outcomes: what do we want students to know and be able to accomplish at the end of this course? The skills [across Bloom taxonomy](#) might be utilized to create the learning objectives. The assessment techniques may follow the learning outcomes: what kind of activities will disclose if students have accomplished the defined learning objectives? It is a good time to consider evaluation approaches that will enable students to show that the course's goal(s) have been fulfilled. Finally, the teaching and learning activities should be chosen: what kinds of activities will reinforce learning goals and prepare students for assessments in and out of class?

The drive to grow autonomously, the development of learning skills, and standard mastery must all be kept in mind while selecting the Tools to Support Students.

Regarding technology in particular, research on education shows that students gain from:

- Learning opportunities that incorporate one-to-one access to technology.
- Internet connectivity at a fast speed.
- Making use of technology that emphasizes exploration and high degrees of involvement.
- The proper ratio of instructors to technology, with very few instances of one without the other.

According to studies in the field of education, students gain from:

- Learning activities that emphasize the development of 21st century skills and higher order thinking abilities (such as problem solving, drawing conclusions, analyzing, and synthesizing).
- Educational activities that rely on culture and the local environment, particularly those that use culturally appropriate methods
- Learning activities that provide students the chance to direct their own learning are advantageous for them.

A high degree of fit within and between these seven essential factors is required for successful technology deployment in education. The abilities, ideas, and convictions of the learning community encompass not only the teacher using the tool but also members of the broader community, including other instructors.

The suitable tools may be classified based on their usability / applicability:

Open Educational Resources allow teachers the freedom to freely access, modify, and disseminate pre-existing educational materials.

Open Educational Resources			
Applied Math and Science Education Repository BCCampus OpenEd Connexions Open Stax Textbooks Coursera	Khan Academy Library of Congress Merslot MIT OpenCourseWare National Center For Case Study Teaching in Science	Open Learn, The Open University Open Stax.org Open Textbook Library PhET Science	Smithsonian Open Access TED The National Academies Press University of



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GapMinder HippoCampus. org	OER Commons	Simulations Play Decide	Hawai'i OER Wikibooks
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Quick montage and editing tools are used to quickly assemble all conceivable forms of materials.

Quick montage and editing		
Clarisketch	Kizoa	Pixton
Comixify	Loom	PosterMyWall
FilmoraGo	Lumen5	Thinglink

Tools for communication, collaboration and sharing are used to facilitate cooperation and imaginative development, group file production, games, and activities. The tools include conversation, sharing, and storage space. As usual, these instruments are used most often.

Tools for communication, collaboration and sharing			
ActionBound	Genially	MonkeyLearn	Prezi
AnswerGarden	Google Classroom	Moodle	Sway
Blogger	Google Drive	MSTeams	Tagxedo
Canva	Khan Academy	LearningApps	TED
Coggle	Lino	Nearpod	Trello
EdWordle	Mentimeter	OneDrive	Tricider
Emaze	MindMup	Padlet	Wakelet

Tools for student assessment and evaluation are used to collect information about students and their work and development

Tools for student assessment and evaluation.		
ActionBound	Khan Academy	Nearpod
Coggle	LearningApps	Padlet
Genially	MindMup	Safe Exam Browser
Google Classroom	Moodle	Socrative
Kahoot	Quizizz	



The Comprehensive List of Online Tools for Teachers



Communication tool “Microsoft teams”

Using Microsoft Teams, you can organize work remotely with a selected group of people (Team): communicate through messages, video, share files. Team work is organized using groups (Teams) and channels – subgroups (Channels). [Try here](#)



Virtual learning environment “Moodle”

Moodle is a free and open-source learning management system. It is used for blended learning, distance education, flipped classroom and other online learning schemes, designed to provide educators, administrators and learners with a single robust, secure and integrated system to create personalized learning environments. [Download](#)



Collaboration tool “Google docs”

Google Docs is free tool that includes: a text editor, a spreadsheet and a presentation editor. This system allows users to create and edit documents online, as well as collaborate on creating a document with other users. You only need a Gmail account to use Google Docs. All documents are stored online, so you can edit (or otherwise use) the document you need while working on another computer. [Try here](#)



Presentation creation tool “Slidewiki”

An international portal developed and curated by the Open University of the United Kingdom together with 17 other organizations from Europe and America. Thanks to this portal, lecturers have the opportunity to create their own presentations or adapt works created

by other authors.

The tool is free. Registration required. [Try here](#)



Collaboration tool “Padlet”

It is an online environment for working together. With the help of this tool you can put the information on the whiteboard or choose the template “post-it” principle. The tool works perfectly synchronously with a large number of users, but can also be asynchronous. By submitting their post, the user can: write, upload a picture, submit video, take a photo with their camera, upload an external link. Registration is required. [Try here](#)



Tests “Kahoot”

Free game-based learning platform, running in real time.

[Try here](#)



Mind map creation tool “Mindomo”

The mind map allows you to: quickly submit a large number of ideas and at the same time connect them by placing each thought to which it belongs. Mind maps are also useful in preparing languages, shaping the course of thought. Computerized mind maps are adapted for group work in a virtual space. [Try here](#)

Mindomo™



Mind map creation tool “Mind Meister”

An online application where you can create diagrams and mind maps. Registration is not required, the program saves your work to the selected location: Google Drive, OneDrive, Dropbox, GitHub or directly to your computer. You can share the created works with others: teachers, students or colleagues.

[Try here](#)



WORDPRESS

Blog “WordPress”

WordPress is the world’s most popular free content management system (CMS), powered by the PHP + MySQL duo. It has all the necessary features needed for both a blog and a website. WordPress has a wide variety of plugins that extend the functionality of this content management system for easy installation. It is also easy to manage and easy to administer CMS. [Download](#)

Event Planning Tool “Doodle”



This tool gives you the opportunity to: conduct a survey of the most appropriate time, date, place (for example – for a project partner meeting), send a link via e-mail to survey participants, view participant selection

statistics. [Try here](#)



For remote assesments “Safe Exam Browser”

Safe Exam Browser is a special browser for remote exams. When you start the browser on your computer, all the other control buttons on your computer are hidden, so you can no longer open other programs on your computer with the help of a mouse or keyboard. The browser is installed on the computer, and in the distance learning environment the quiz settings are selected – Browser Security: Require the use of a Safe Exam browser. [Download](#)



Mentimeter

Collaboration tool “Mentimeter”

It is an online environment used to create presentations with real-time feedback. It also focuses on online collaboration for the education sector allowing students or public members to answer questions anonymously, enables users to share knowledge and real-time feedback on mobile with presentations, polls or brainstorming sessions in classes, meetings, gatherings, conferences and other group activities. [Try here](#)



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Collaboration tool “AnswersGarden”

It is an easy-to-use polling tool that allows a teacher to quickly collect students' thoughts and ideas. It adopts a minimalist design that allows users to create, to share, to answer and to manage topic questions without signing up for accounts. Although it is a simple app, it has the potential to be used to accomplish a wide range of educational tasks, such as brainstorming, polling, synchronous and asynchronous communication, and formative assessment. [Try here](#)

This package of activities will include improving and updating teaching methods, updating and developing the content of the subject. The outcome of this package will be a curriculum and teaching materials, as well as a European Handbook/Innovative Guide for Higher Education on the Impacts of Global Warming on Aquaculture and Fisheries.

All modules in the national language version are to be tested during the pilot test. This means that each partner will test all modules in their national language. To be considered a trained person, the person/student/trainee must have taken and passed the assessment of these modules.



Chapter 4, Modules

Training structure

The course is designed to equip students with the skills needed to apply DiBluCa's theoretical foundations and practical building blocks in real-world situations. Results from the questionnaire confirmed the project's assumptions about the dissemination of DiBluCa project modules. Survey results show that students are eager to gain more knowledge about climate change and its impact on aquaculture. They are receptive to innovative learning methods and recognize the potential career benefits of this knowledge. Partners involved in module development and maintenance should prioritize the needs of educators and students/trainees, as recent changes and developments in these areas indicate. It's clear that there is a strong need to develop new techniques and tools, as well as to adapt existing ones, to meet the needs of the target audience.

All training materials must include knowledge beneficial for students and trainees in the aquaculture, ecology, environmental technology, veterinary, fisheries, and fishery's feed processing sectors, according to the consensus on the training content transferred from the core DiBluCa project.

The training material should emphasize current methods and tools in the context of the impact of global warming on aquaculture. Current educational resources include articles, national and international textbooks, magazines, and other similar materials. These resources will be designed to be engaging and useful before being incorporated into an e-learning platform and made available for download under a Creative Commons license. The expanded curriculum will be available in English and the languages of all partner countries.

The training materials will comply with EQF (European Qualifications Framework) documents and use EQF definitions for student and trainee achievements. Learning outcomes are defined as follows:

- **Knowledge:** In the context of EQF, knowledge is described as theoretical and/or factual in broad contexts within a field of work or study.
- **Skills:** In the context of EQF, skills are described as cognitive (involving logical, intuitive, and creative thinking) and practical (involving manual dexterity and the use of methods, materials, tools, and instruments). A range of cognitive and practical skills required to generate solutions to specific problems in a field of work or study
- **Responsibility and Autonomy:** In the context of EQF, responsibility and autonomy are described as the learner's ability to apply knowledge and skills independently and responsibly. Exercise self-management within the guidelines of work or study contexts that are usually predictable, but are subject to change; supervise the routine work of others, taking some responsibility for the evaluation and improvement of work or study activities

Level 4 of the EQF will be suitable for this training. All partners are encouraged to adapt the national versions of the training content to higher levels of the EQF as needed.

Module Design

After evaluating the potential participants' needs and interest levels, the training modules have been developed to be accessed in a flexible and customizable manner, tailored to the capabilities and existing skills of the trainees.

When planning instructional modules and courses, keep these factors in mind:



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1. **Clear Objectives:** Ensure students understand and are working towards the module's stated goals. Your module should have measurable, attainable objectives or outcomes. Consider what you want students to have learned, understood, and be able to demonstrate by the end of the program. Learning outcomes or goals describe the knowledge, skills, and understandings that students will achieve upon completing the module.
2. **Educational Goals Framework:** Many educational goals are based on a pyramidal theory of knowledge initially proposed by Benjamin Bloom in the 1950s. While Bloom's model has been refined and scrutinized over time, it remains a valuable framework for considering educational outcomes.

Bloom classifies learning into tiers of increasing complexity, from the most basic abilities like memorization to more complex ones like analysis and reflection. Typical module learning outcomes can be mapped onto Bloom's hierarchy, illustrating how learning progresses from lower to higher levels.

A brief overview of Bloom's hierarchy of cognitive skills includes:

1. **Remembering:** The ability to recall or recognize specific information.
2. **Understanding:** The ability to comprehend the meaning of information.
3. **Applying:** The ability to use information in new situations.
4. **Analyzing:** The ability to break down information into components to understand its structure.
5. **Evaluating:** The ability to judge the value or effectiveness of information based on criteria.
6. **Creating:** The ability to put together elements to form a new, coherent whole or make an original product.

Mapping module learning outcomes onto Bloom's hierarchy can help ensure that the training program addresses a comprehensive range of cognitive skills, enabling students to progress from foundational knowledge to higher-order thinking.

These guidelines will help in designing modules that are effective, focused, and aligned with the overall educational goals of the program.

3. **Ensure Positive Alignment:** Make sure your module is positively aligned, meaning that learners actively construct their own understanding and all teaching and assessment activities are aligned with the intended outcomes. When learning goals or objectives are aligned with instruction and evaluation, the module can be considered successful—a concept known as constructive alignment.

Consider the following aspects to achieve constructive alignment:

- **Learning Activities:** What learning activities do you want your students to engage in to achieve these learning outcomes? Think about interactive exercises, group projects, discussions, hands-on practices, and other activities that encourage active learning.
- **Tasks and Assessments:** What types of tasks will best bring about the desired educational outcomes? Design tasks that require students to apply what they've learned, analyze information, and create new ideas. Assessments should directly measure the learning outcomes and may include quizzes, essays, presentations, or practical demonstrations.



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- **Required Material:** Determine the type of material needed to meet the learning goals. This includes textbooks, articles, videos, software, and other resources that provide the necessary information and context.
- **Support for Students:** Identify the kinds of assistance students will need to achieve the learning goals. This might involve providing supplementary materials, offering tutoring or mentoring, or creating opportunities for peer support.
- **Evaluation Methods:** Develop effective ways to evaluate whether students have met the learning outcomes. This can include formative assessments (ongoing checks for understanding), summative assessments (final evaluations), and self-assessments.
- **Checking Alignment:** Regularly review and adjust the course to ensure it effectively links learning objectives with activities and assessments. Collect feedback from students, observe their engagement and performance, and make necessary adjustments to improve alignment.

By ensuring positive alignment, you can create a cohesive and effective learning experience that supports students in achieving their educational goals.

To implement the DiBluCa project goals, the following topics will be covered during the training and responsible partners are:

MODULE 1. Effects of global warming on water quality and impact on aquaculture, VDU, LT

MODULE 2. Global warming and breeding, biotechnology in aquaculture – ONUT, UA

MODULE 3. What should change feed and feeding in aquaculture due to global warming, BAUN, TR

MODULE 4. System selection against global warming in aquaculture, UTH, GR

MODULE 5. Environmental impacts of aquaculture from global warming perspective, UNIDU, HR

MODULE 6. Effects of global warming on diseases in aquaculture and protective applications, VDU, LT



Chapter 5, Success indicators

Success indicators will be measured using Donald L. Kirkpatrick's four levels of learning assessment throughout the evaluation process. This involves defining assessment standards and determining how the effectiveness of the training will be assessed.

The Kirkpatrick Model divides training evaluation into four levels:

1. **Reaction:** This level assesses participants' reactions to the training, such as their satisfaction with the content, delivery, and instructor. Feedback from participants through surveys or interviews is collected to gauge their initial response to the training.
2. **Learning:** The learning level evaluates the extent to which participants have acquired new knowledge, skills, or attitudes as a result of the training. This assessment often involves pre- and post-tests or quizzes to measure changes in understanding and capability.
3. **Behavior:** This level examines whether participants have applied what they learned in the training to their actual work or daily lives. Observations, performance assessments, or self-reports may be used to determine if there has been a change in behavior as a result of the training.
4. **Results:** The results level measures the impact of the training on organizational goals or outcomes. This could include improvements in productivity, quality of work, customer satisfaction, or other key performance indicators. Data analysis and comparison with pre-established benchmarks are often used to assess the effectiveness of the training in achieving desired results.

By utilizing these four levels of assessment, we can comprehensively evaluate the success of the training program and make informed decisions for future improvements.

The starting point, **Reaction**, places the learner at the forefront, evaluating if the training was engaging and beneficial for their job. This is subdivided into three parts:

1. **Satisfaction:** Measures the learner's contentment with the material covered during their training.
2. **Engagement:** Assesses the extent to which the learner actively participated in and contributed to the learning process.
3. **Relevance:** Determines the applicability of the acquired knowledge in the learners' workplace.

After the training session, a survey is commonly employed to gather feedback. Participants are asked to rate their overall satisfaction with the training and provide comments, often referred to as a "smile sheet."

The survey may cover various topics, including program objectives, course materials, content relevance, and instructor expertise.

Guidelines for Implementing Level 1

- **Utilize an Online Survey Platform:** Choose a reliable online tool to efficiently gather feedback.
- **Allocate Time at the End of the Training for the Survey:** Schedule time at the end of the training session for participants to complete the survey.
- **Allow for Open-Ended Responses:** Encourage participants to provide detailed written feedback instead of restricting them to multiple-choice questions.



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- **Pay Attention to Verbal Feedback:** Take note of verbal comments made during the training sessions for additional insights.
- **Design Questions Focused on Learned Material:** Develop survey questions that specifically address the content covered during the training.
- **Integrate Insights from Previous Surveys:** Use insights from previous surveys to refine and improve the current survey questions.
- **Inform Participants at the Beginning:** Let participants know at the start of the session that they will be asked to complete a survey. This encourages more thoughtful and reflective responses.
- **Emphasize the Importance of Honesty:** Stress the importance of honest feedback. Encourage participants to provide genuine comments, including constructive criticism and positive remarks.

Level 2, **Learning**, evaluates whether the learner has acquired the knowledge, skills, attitude, confidence, and commitment that the training program aims to impart. These five aspects can be measured through formal and informal methods. Pre- and post-learning tests are essential to ensure accurate assessment of results.

Guidelines for Implementing Level 2:

- **Pre- and Post-Tests:** Administer pre- and post-tests to obtain a comprehensive understanding of the knowledge and skills acquired during the training.
- **Questionnaires and Surveys:** Utilize various forms of questionnaires and surveys, such as tests, interviews, and evaluations, to assess the learner's progress.
- **Control Group:** In certain situations, employing a control group can be beneficial for comparing outcomes.
- **Scoring Procedure:** Clearly specify and establish the scoring procedure in advance to avoid discrepancies.
- **Alignment with Objectives:** Ensure that the assessment techniques align with the objectives of the training program.
- **Incorporate Feedback:** Incorporate feedback from both teachers and students, including their insights, observations, and criticisms, as they provide valuable information.

By following these guidelines, trainers can effectively evaluate the extent to which learners have attained the intended knowledge, skills, attitude, confidence, and commitment outlined in the training program.

Level 3, **Behavior**, is crucial in assessing the effectiveness of training as it examines whether learners apply their acquired knowledge and skills in their job roles. It focuses on observing behavioral changes following the training and evaluates whether learners utilize the training in their workplace. This level also investigates the necessary drivers, such as processes and systems that reinforce, promote, and reward key work behaviors. The examination at this level reveals whether the training has been understood by the learners and whether it proves useful in their job performance.

Guidelines for Implementing Level 3:



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- **Minimize Opinion-Based Observations:** Avoid or minimize observations based solely on opinions to prevent skewing of results.
- **Start with Small Evaluations:** Initiate with small evaluations and observations to begin understanding the changes. As changes become evident, utilize more substantial tools like interviews or surveys for measurement.
- **Define Clear Change Objectives:** Have a clear understanding of the desired changes resulting from the training. Define what skills learners should use and how proficiency in these skills will be demonstrated.
- **Assess Magnitude and Frequency of Change:** Consider the extent of change observed in learners and how frequently they apply their new skills. Determine if the changes are sustainable in the long term.
- **Complement with Other Techniques:** Utilize evaluations in conjunction with other management and training techniques to enhance effectiveness and reliability.

By adhering to these guidelines, trainers can effectively assess behavioral changes resulting from training and ascertain the extent to which learners apply their newfound knowledge and skills in their workplace roles.

Level 4, **Results**, examines whether the training program has achieved the desired outcomes and assesses the support and responsibility of the organization's members. This level also considers "leading indicators," which are short-term observations and measurements indicating that key behaviors are progressing towards producing positive effects on desired results.

Guidelines for Implementing Level 4:

- **Clarify Measurement Methods:** Before beginning the evaluation process, ensure a clear understanding of how results will be measured, and communicate this to all involved stakeholders.
- **Allow Sufficient Time for Evaluation:** Avoid rushing through the final evaluation process. It's essential to give individuals adequate time to apply their new skills and behaviors.
- **Ensure Accurate Observations:** Conduct observations accurately, ensuring that observers comprehend the type of training and its objectives.
- **Combine Feedback with Observations:** While feedback from participants is valuable, it is most effective when combined with observational data.

Results and areas of influence can be readily observed and measured at all levels of the Kirkpatrick Model. This analysis allows instructors to adjust the learning path as needed and better understand the connections between each level of instruction. Consequently, the training program will become stronger and more effective over time.

To evaluate trainees' overall performance capabilities and the knowledge gained during training, an evaluation questionnaire based on multiple-choice questions will be designed. This evaluation will occur at the end of each module in an online setting.

Additionally, a specialized user satisfaction questionnaire will be utilized to measure participants' comprehension, particularly during the piloting and early editions of training. This will facilitate subsequent corrections and redesigns in preparation for future editions, ensuring continual improvement.



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