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The Digital Blue Carrier for a Post-Carbon Future - Curriculum Innovations in Aquaculture [DiBluCa]"
2023-1-LT01-KA220-HED-000154247

WP2A1- Compendium workshops for state-of-the-art report

"General Report"

Elaborated by Balikesir University (BAUN),
and all Partners

Funded by the European Union

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

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DOCUMENT INFO	
PROJECT	The Digital Blue Carrier for a Post-Carbon Future - Curriculum Innovations in Aquaculture [DiBluCa]"
ACTIVITY	A1- Compendium workshops for state-of-the-art report
STATUS	Final version 31/03/2024

Content **Page**

1. DiBluCa Project

Objectives: What do you want to achieve by implementing the project? The Erasmus+ program aims to improve skills and job chances. 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. Implementation:

Activities: The DiBluCa project will be carried out in four phases: design, localise, 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 ebook will be accessible in the languages of all project partners.

Results: What project results and other outcomes do you expect your project to have? 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.

Target groups: 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.

2. Activity Description

Activity title: PR2A1-Compendium workshops for state-of-the-art report
Start and End Dates: 01/11/2023- 31/03/2024
Leading Organisations: Balıkesir University, TR
Aims and Methodology of the Activity: The main aim is to analyse the current situation in the world and partner countries. So, for the achievement of Objective 1, working on Compendium workshops for the state-of-the-art report, organising compendium workshops with stakeholders (academicians, researchers and representatives and technical staff of the sector) to discuss the impact of global warming and over-fishing on aquaculture and needs of the industry against global warming, new trends in aquaculture and skills that qualified personnel need in the future of aquaculture sector. In this work package, it is planned to organise 5 compendium workshops with at least 40 stakeholders from each partner, with a total of 200 participants for the state-of-the-art report. The report will be for each partner and a general report in English and translated into the partner's languages. Two questionnaires

will be distributed in the workshops, one for academicians/ lecturers and one for aquaculture higher education bachelor and master/ PhD students. The expected impact of this report is to know the needs of the stakeholders and reach the latest data on the partners' countries for aquaculture and aquaculture higher education, and to create awareness of global warming and aquaculture relationship and knowledge of aquaculture.

3. National SoA Reports

Lithuania

In Lithuania, VMU shared questionnaire via internet with academicians/lecturers and students. 26 responds from academics/lecturers and 25 responds from students were received. A total of 51 participants filled in the questionnaire.

The results of the questionnaires are as below:

- The academic community, primarily consisting of Associate Professors, Lecturers/Researchers, and Professors, represents a significant portion of the participants in this Questionnaire. Most student participants are from the faculties of Forestry and Ecology, and Agriculture, though many also come from such as Law and Social Sciences. These faculty members constitute a substantial part of the student and researcher population. Notably, Lithuanian universities currently lack a specialized aquaculture curriculum, some courses are delivered mostly at the undergraduate level, featuring both optional and mandatory courses for master's programs.
- The participants, including both academics and students, have expressed a strong consensus on the necessity for enhanced knowledge and skills related to climate change, the implications of a post-carbon future, and emerging topics in aquaculture education to mitigate climate change effects. The environmental impact of aquaculture, especially concerning global warming, stands out as the most pressing issue, alongside concerns such as breeding, biotechnology, and disease management. There is, however, less demand for knowledge in breeding system selection.
- A significant portion of the respondents believes that topics on climate change and envisioning a post-carbon future should be incorporated into the undergraduate aquaculture curriculum. The educational resources currently used include both national and international textbooks, journals, and other similar materials. A notable finding is that more than two-thirds of the participants are not familiar with the term "Blue Carrier," though many are aware of concepts like global warming and post-carbon futures, with about one-quarter lacking a deep understanding of these topics. There is a strong desire among the majority to acquire more knowledge in these areas.
- Furthermore, students indicate that their universities, along with e-learning platforms and open educational resources (OER), could provide more reliable knowledge on aquaculture. They also believe that an innovative post-carbon aquaculture curriculum could enhance their career prospects within the future aquaculture industry. In terms of preferred learning environments, students favour

a blended approach that combines face-to-face interactions with online or flexible delivery methods.

Ukraine

In Ukraine, ONUT shared questionnaire via internet with academicians/lecturers and students. 23 responds from academics/lecturers and 31 responds from students were received. A total of 54 participants filled in the questionnaire.

The results of the questionnaires are as below:

- The academic community, primarily consisting of Associate Professors, Lecturers/Researchers, and Professors, represents a significant portion of the participants in this Questionnaire. Most of the students are students from the Faculty of Ecology and the Faculty of Agriculture. These teachers make up a significant part of the students and researchers. At the moment, there are no specialized educational programs in aquaculture in Ukrainian universities, some courses are taught mainly at the undergraduate level, including optional and mandatory courses for master's programs.
- The participants, including both academics and students, have expressed a strong consensus on the necessity for enhanced knowledge and skills related to climate change, the implications of a post-carbon future, and emerging topics in aquaculture education to mitigate climate change effects. The environmental impact of aquaculture, especially concerning global warming, stands out as the most pressing issue, alongside concerns such as breeding, biotechnology, and disease management. There is, however, less demand for knowledge in breeding system selection.
- A significant portion of the respondents believes that topics on climate change and envisioning a post-carbon future should be incorporated into the undergraduate aquaculture curriculum. The educational resources currently used include both national and international textbooks, journals, and other similar materials. A notable finding is that more than two-thirds of the participants are not familiar with the term "Blue Carrier," though many are aware of concepts like global warming and post-carbon futures, with about one-quarter lacking a deep understanding of these topics. There is a strong desire among the majority to acquire more knowledge in these areas.
- Furthermore, students indicate that their universities, along with e-learning platforms and open educational resources (OER), could provide more reliable knowledge on aquaculture. They also believe that an innovative post-carbon aquaculture curriculum could enhance their career prospects within the future aquaculture industry. In terms of preferred learning environments, students favour a blended approach that combines face-to-face interactions with online or flexible delivery methods.

Turkiye

In Turkiye, BAUN shared questionnaire via internet with academicians/lecturers and students. 14 responds from academics/lecturers and 29 responds from students were received. 10 students also completed the printed version of the questionnaire. A total of total of 53 participants filled in the questionnaire.

The results of the questionnaires are as below:

- The majority of the participants from academics are Assoc. Prof./Asst. Prof. and Lecturer/ Research Asst. followed Prof. Dr. and Specialists. Most of the participants from students are from veterinary and agricultural faculties. Most of the academics and students are from faculties. In their universities veterinary medicine, agricultural and aquaculture faculties provide aquaculture education at the undergraduate level. It is the same in other Turkiye's universities. The aquaculture courses are mostly in undergraduate level but there are elective and compulsatory courses at master and PhD levels.
- The academics and the students indicated that they need to have skills and knowledge on climate change, post carbon futureand new topics in aquaculture education to mitigate the effect of climate change.
- The academics and the students concluded that changes in feeds and feeding mode is the most important issue. They also indicated that water quality and environmental impacts of aquaculture from global warming perspective are important issues. They need less knowledge in breeding and biotechnology, breeding system selection and disease outbreak and proactive applications.
- The majority of the participants think about climate change and post carbon future for aquaculture as a topic in the undergraduate curriculum**.**
- The participants indicated that training/education material courses provided on aquaculture in their institution are national and international text books and articles and similar resources.
- Half of the participants don't familiar with the term Blue Carrier but most of them familiar with the terms "global warming and post carbon future". They 1/3 of them don't have satisfactory knowledge about these topics. The vast majority of the participants want to have these knowledge.
- The students pointed out that the university can provide more reliable information about aquaculture for them. They also voted for university-e-learning/OERs.
- Most of the students think that an innovative curriculum on post-carbon aquaculture will be useful for them and they belive that this innovative curriculum will increase job opportunities of them in future aquaculture sector.
- The students prefer work-integrated learning and blended learning (mixture of face-to-face and online/flexible delivery) as learning environment to learn this curriculum.

Greece

In Greece, UTH shared questionnaire via internet with academicians/lecturers and students. 31 responds from academics/lecturers and 46 responds from students were received. A total of 77 participants filled in the questionnaire.

The results of the questionnaires are as below:
The survey of educators identified a key theme: the need to update curriculums to address climate change and its impact on the future of aquaculture. The main key findings of the survey are as follows:

- A significant majority of respondents believe knowledge and skills related to climate change are essential for future aquaculture professionals.
- Educators expressed a strong preference for incorporating practical learning opportunities, such as work-integrated learning, into the curriculum.
- The survey suggests a blended approach to course delivery is preferred, with both traditional resources and innovative tools being utilized.
- There is divided support for curriculum development, with some favoring specialized undergraduate courses and others advocating for postgraduate programs focused on continuing professional education.
- *Overall*, the survey underscores the need for a forward-thinking approach to aquaculture education. Equipping students with the knowledge and skills to navigate the challenges of climate change will be critical for the long-term sustainability of the aquaculture industry.

The survey of university students identified a key theme: strong interest in acquiring knowledge and skills related to the impact of climate change on the future of aquaculture. The main key findings of the survey are as follows:

- While some students are unfamiliar with the term Blue Carrier, most have a general awareness of climate change.
- Students acknowledge a need for improved knowledge on the impact of climate change on aquaculture, with a significant portion lacking complete knowledge.
- Universities remain the primary source of information, with e-learning resources gaining popularity.
- There is a sense that educators and industry professionals may benefit from further knowledge on the post-carbon future of aquaculture.
- Students overwhelmingly support the development of an innovative curriculum focused on the topic of aquaculture in the post carbon era.
- Students storngly believe such a curriculum could enhance future job prospects and prefer a

blended learning approach that combines traditional and online methods.

- *Overall*, the survey indicates a student population eager for deeper knowledge on climate change and its impact on aquaculture. They are open to innovative learning methods and see the potential for this knowledge to benefit their careers.

Croatia

In Croatia, UNIDU shared questionnaire with the participants in a face-to-face meeting. 16 respondents from academics/lecturers and 10 students completed the printed version of the questionnaire. A total of 26 participants filled in the questionnaire.

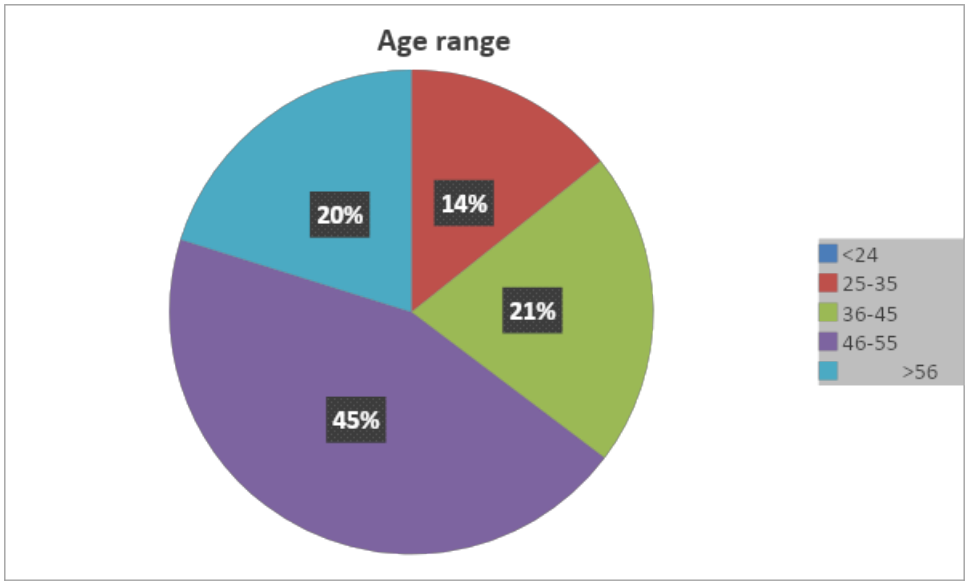
The results of the questionnaires are as below:

- Most participants from academia are lecturers/research assistants, followed by Prof. Dr. and Assoc. Prof./Asst. Prof. Most student participants come from the Faculty of Aquaculture and Mariculture. Most academics and students come from the faculties. At their faculties, aquaculture is offered as an elective and compulsory subject in the Bachelor's and Master's degree programs.
- The academics and students indicated that they need skills and knowledge about climate change, the post-carbon future and new topics in aquaculture education to mitigate the effects of climate change.
- The academics concluded that the choice of farming systems is the most important issue, but also disease outbreaks and proactive applications, environmental impacts of aquaculture from a global warming perspective and changes in feeds and feeding methods. Breeding and biotechnology as well as water quality are also very important.
- The majority of participants are thinking about climate change and the post-carbon future of aquaculture as a topic for the undergraduate curriculum.
- Participants indicated that the training/educational material on aquaculture provided in their institution includes national and international textbooks, articles and similar resources, as well as experiments, equipment, models, videos, artificial intelligence, etc.
- More than half of the participants are not familiar with the term "blue carrier", but all of them know the terms “global warming and post-carbon future”. 1/3 of the participants have no idea about these topics. The vast majority of participants would like to acquire this knowledge.
- Students stated that the university can provide them with more reliable information about aquaculture, followed by specialized courses and broadcast media.
- Most of the students believe that an innovative post-carbon aquaculture curriculum will be beneficial for them, and they believe that this innovative curriculum will increase their job opportunities in the future aquaculture sector.
- Students prefer work-integrated learning and blended learning (a mix of face-to-face and online/flexible courses) as a learning environment for learning this curriculum.

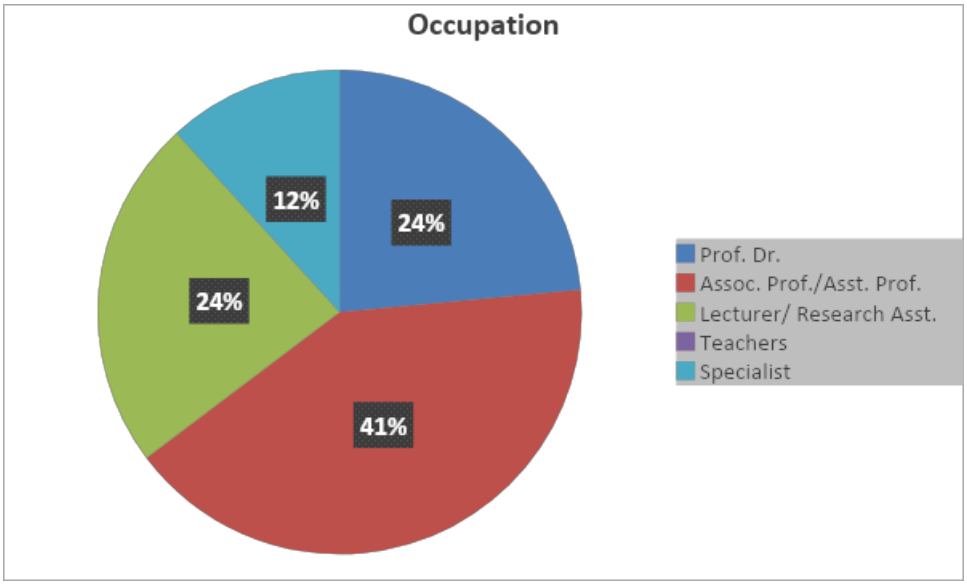
4. General SoA Report

Participants: The DiBluCa project aimed to collect two questionnaires: One for academics/lecturers and one for bachelor/master/PhD students from higher education institutions. Five partners collected questionnaires from 110 academics/lectureres and 151 questionnaires from the students. Thus, the minimum number of participants in the project, determined as a total of 200 surveys, was 261.

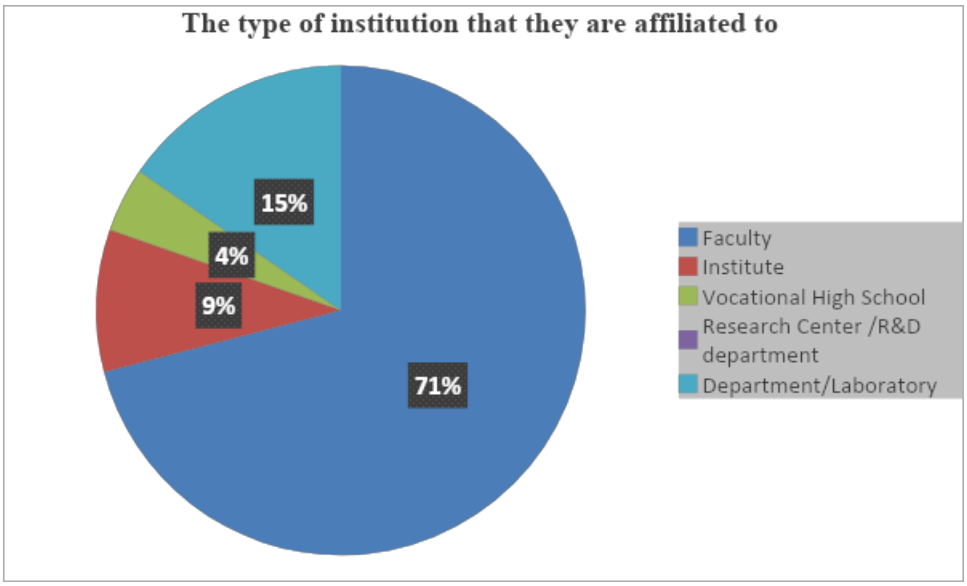
1) **Age range:** Almost half of the participants (45%) are 46-55 year old, followed 36-45 age and 56+ age range groups.



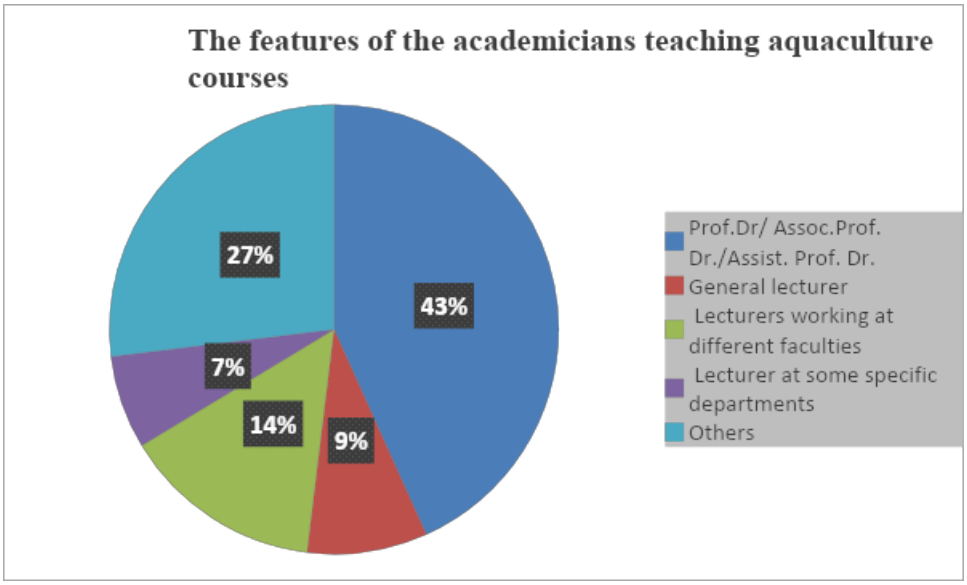
2) **Occupation**: 41% of the respondents were Assoc. Prof./Asst. Prof. and Lecturer/ Research Asst., followed Lecturers/research assit and Prof. Dr.



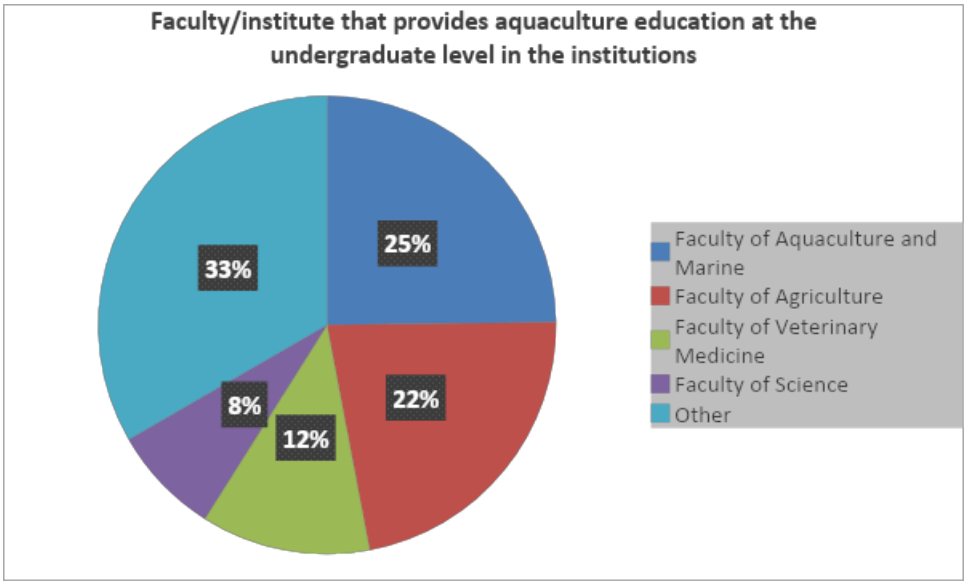
3) **The type of institution that they are affiliated to:** The vast majority (71%) of the respondents are faculty academic staff, followed departments/laboratories and institute..



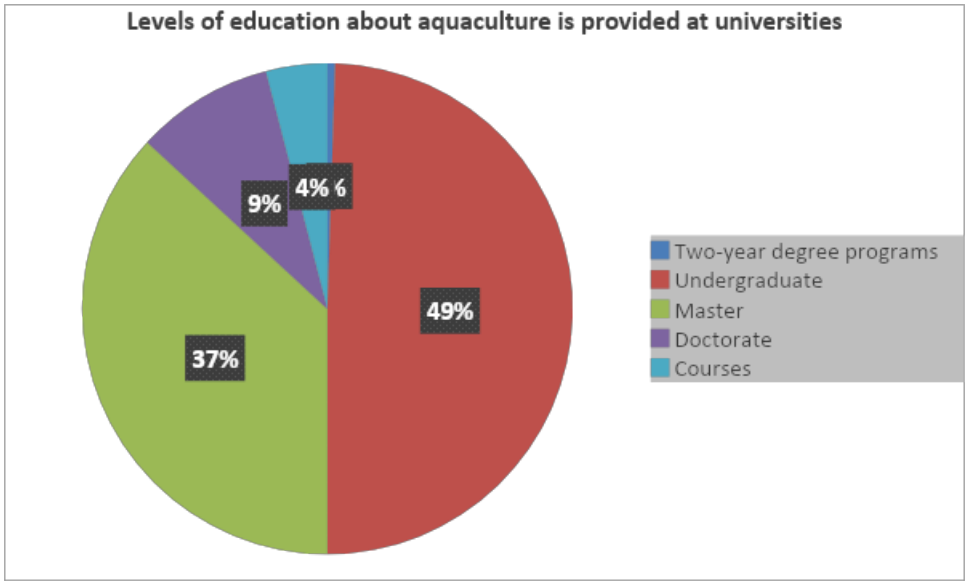
4) **The features of the academicians teaching aquaculture courses:** Most of the academicians teaching aquaculture courses are Prof.Dr/ Assoc.Prof. Dr./Assist. Prof. Dr. (43%), followed other academic staff and lecturers working at different faculties.



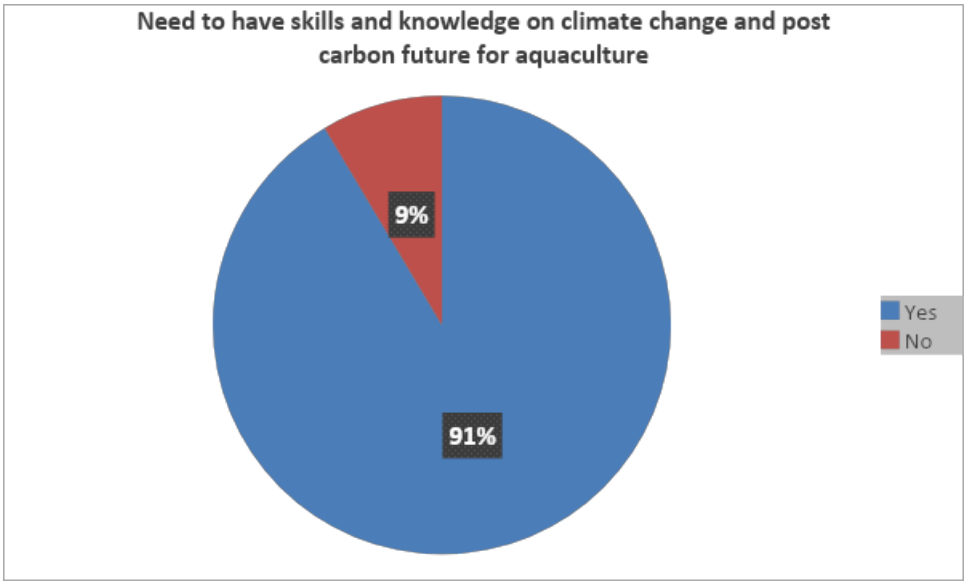
5) **The faculty/institute provides aquaculture education at the undergraduate level in their institution:** The respondents voted 'others' (33%) as aquaculture education providing institutes. However, faculty of aquaculture and marine (25%), faculty of agriculture (22%) faculty of veterinary medicine and faculty of science are also provide aquaculture education at partner universities. The majority of that provides education is veterinary faculty and followed other faculties/vocational high schools. In Ukraine department of ecology, water and technologies of environmental protection; ecology, technologies of environmental protection, technologies of meat and fish products provide aquaculture higher education.



6) **Levels of education about aquaculture is provided at their university:** The vast majority of the aquaculture education is provided at undergraduate level (49%) and master level (37%), folowed doctarate level and courses.

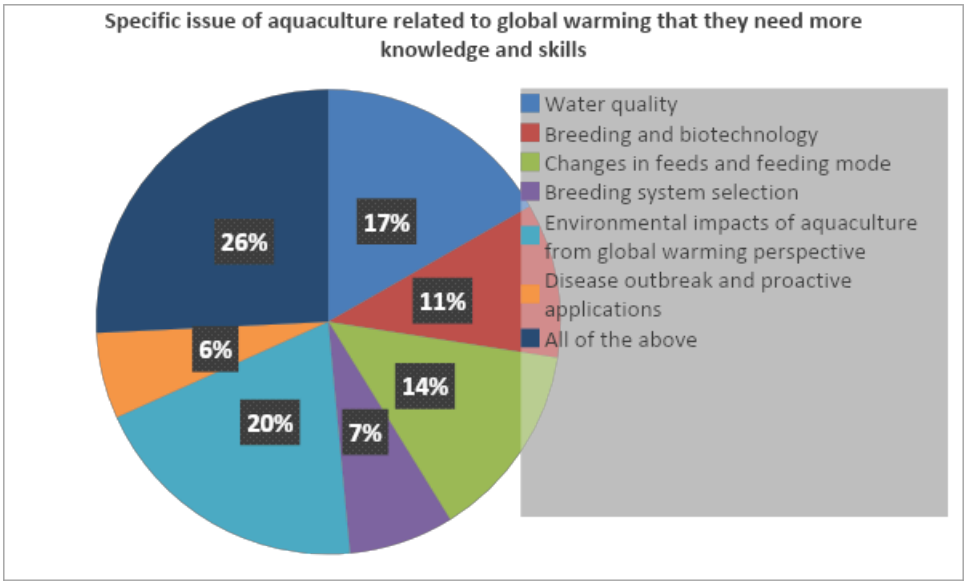


7) **Need to have skills and knowledge on climate change and post carbon future for aquaculture:** 91% of the respondents indicated that they need to have skills and knowledge on climate change and post carbon future for aquaculture.

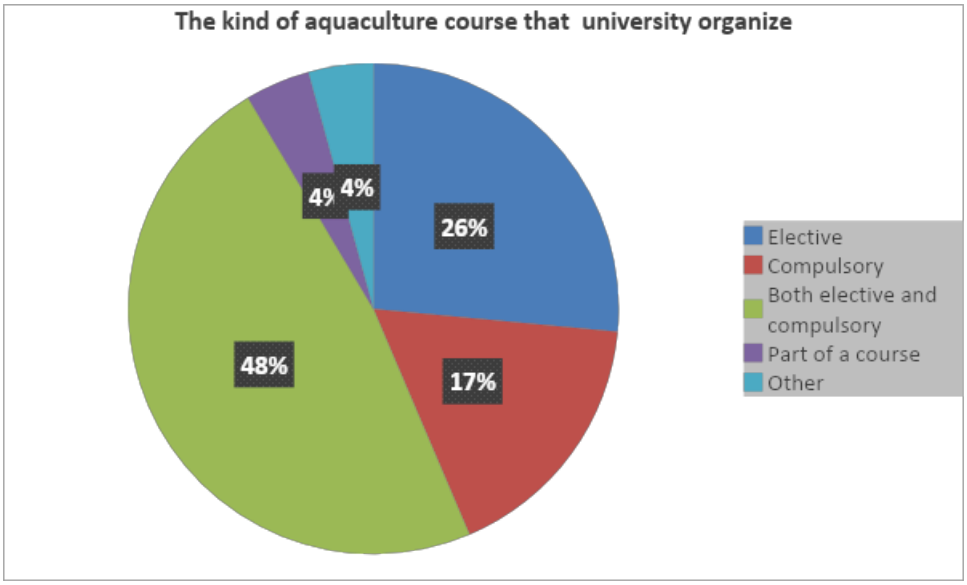


8) **Which specific issue of aquaculture related to global warming they need more knowledge and skills:** 26% of the respondents indicated that they need all issues of global warming affect on

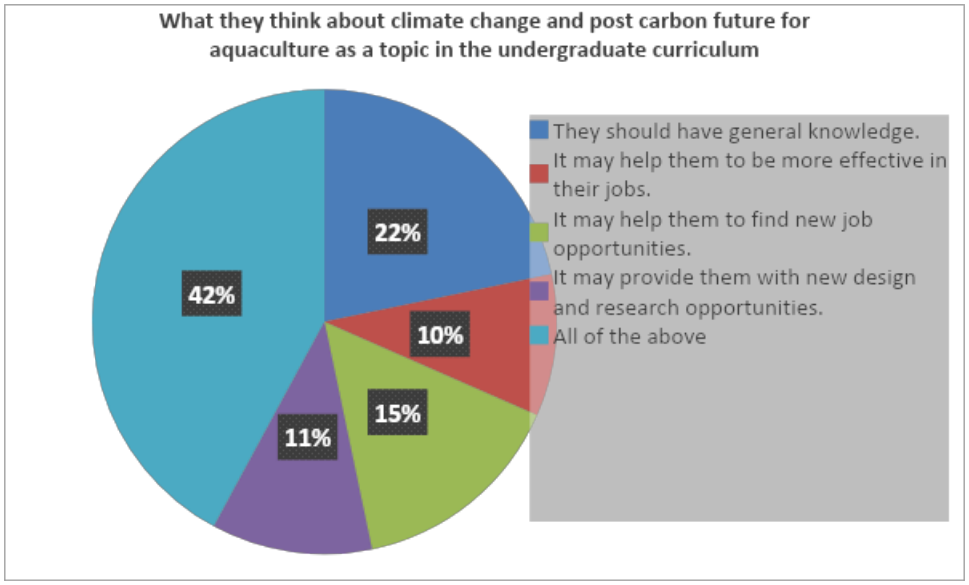
aquaculture. Environmental issues, water quality and changes in feeds and feeding mode have also high priorities. about climate concluded that changes in feeds and feeding mode is the most important issue. They also indicated that water quality and environmental impacts of aquaculture from global warming perspective are important issues. They need less knowledge in breeding and biotechnology, breeding system selection and disease outbreak and proactive applications.



9) **Kind of aquaculture courses that their universities organize:** Both elective and compulsory courses are the main kind of course (48%) at their universities, folowed elective (27%) and compulsory (17%).

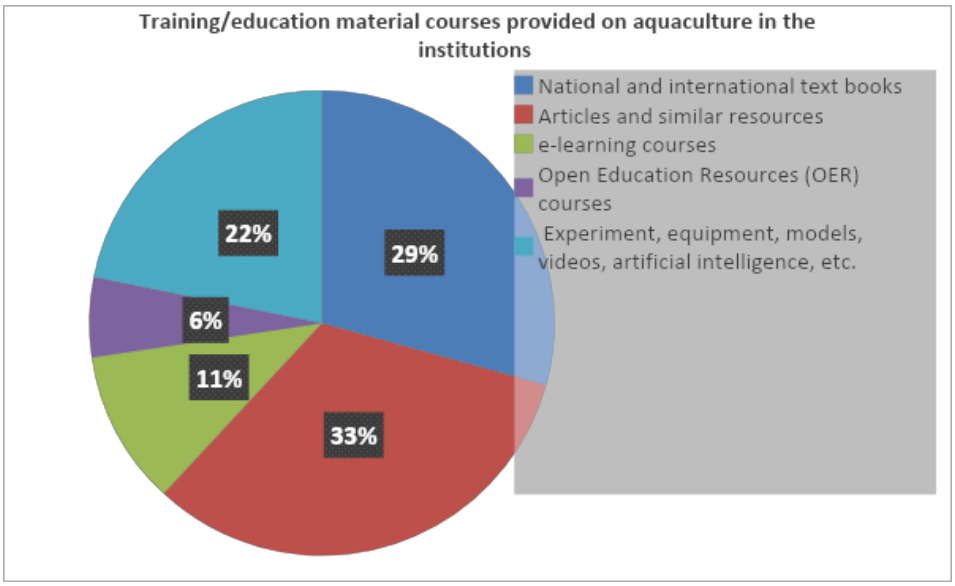


10) **What they think about climate change and post carbon future for aquaculture as a topic in the undergraduate curriculum:** The majority of the participants (42%) voted "All of the above". 22% of the respondents think that it should have general knowledge. The respondents think that it may help them to find new job (15%) and to be more effective in their job (10%).

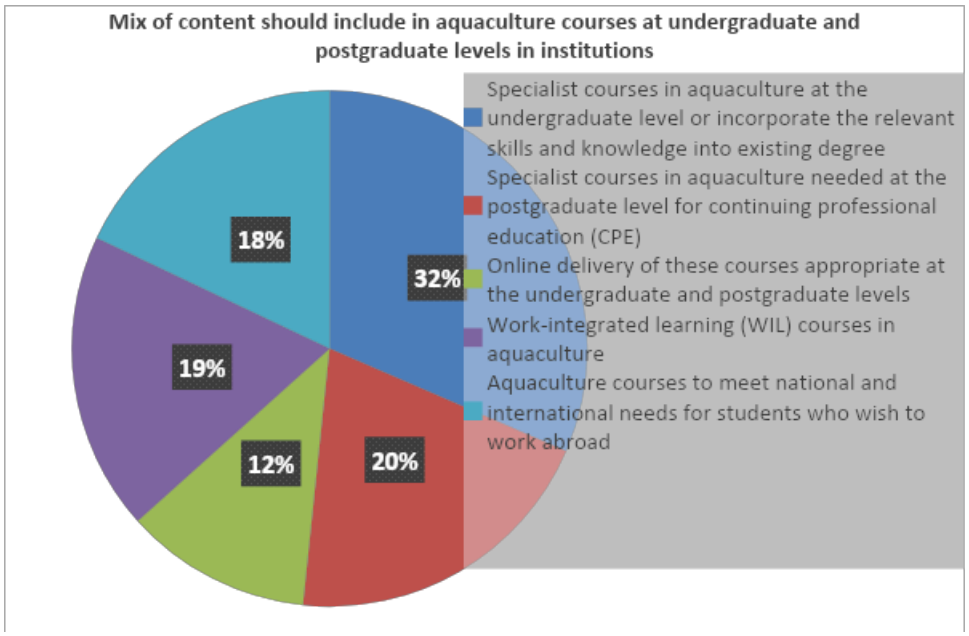


11) **Training/education material courses provided on aquaculture in their institution**: The participants (33%) pointed out that articles and similar resources provide training/education material courses on aquaculture in their institutions, followed national and international text books

(29%), experiment,equipment, models, videos, artificial intelligence, etc. (22%) and e-learning (11%).



12) **The mix of content included in aquaculture courses at undergraduate and postgraduate levels in their institution:** 31% of the responded reported that specialist courses in aquaculture at the undergraduate level or incorporate the relevant skills and knowledge into existing degree should be included in aquaculture courses. 20% of them indicated CPE, followed WIL (19%) and aquaculture courses to meet national and international needs for students who wish to work abroad.



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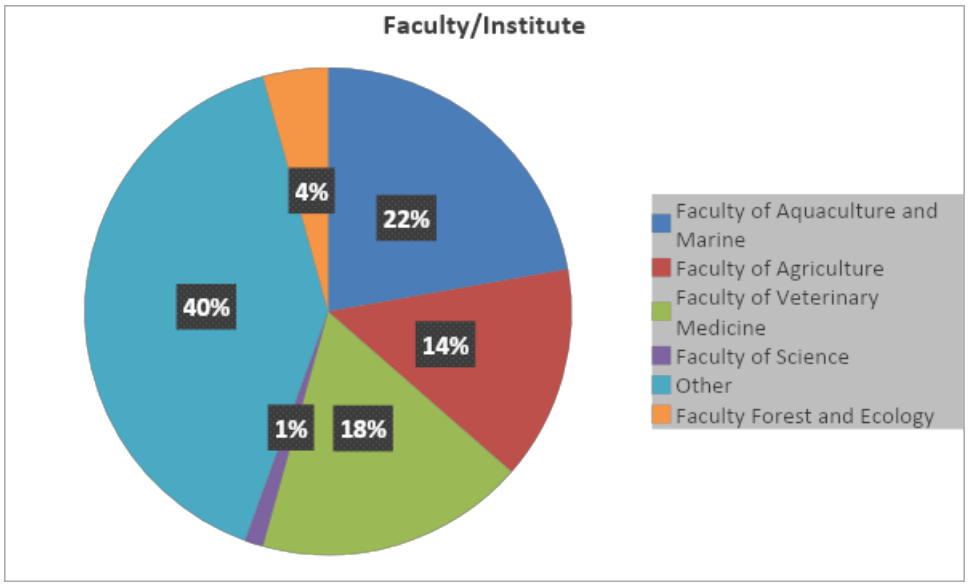
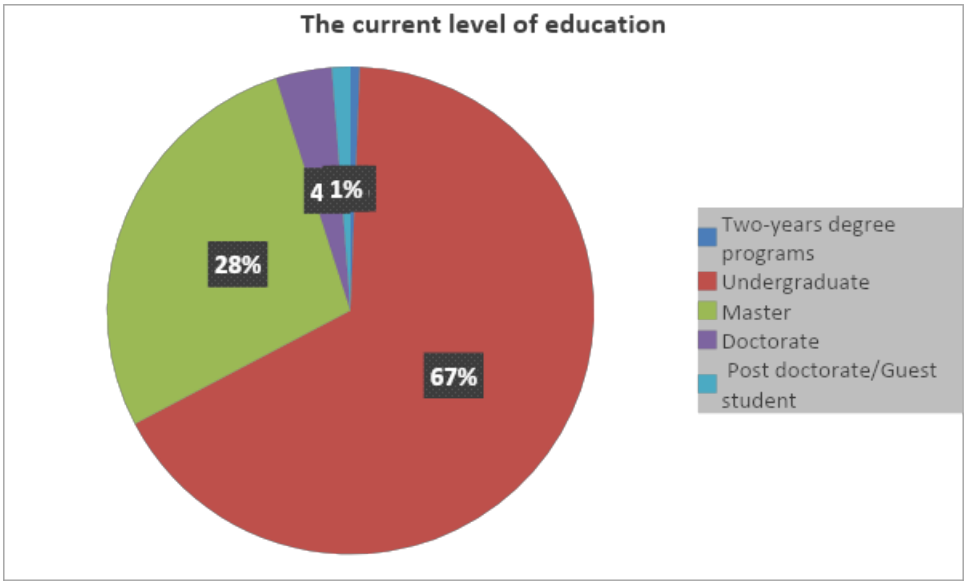
The Results of Questionnaire 2 (Students)

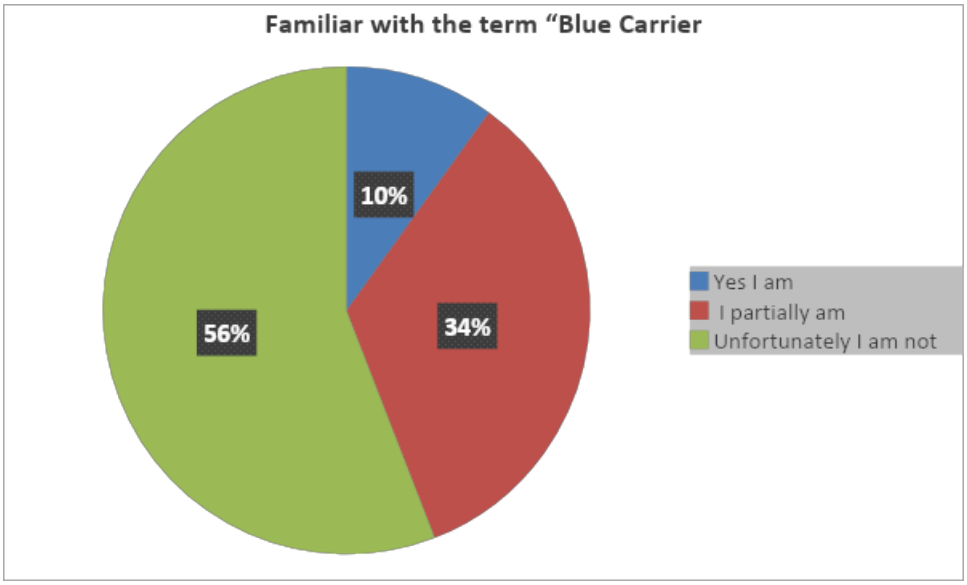
1) **Faculty/Institute of the participants**: 40% of the respondents are from other faculties (faculty of ecology and forestry, department of ecology, water and technologies of environmental protection; ecology, technologies of environmental protection, technologies of meat and fish products), followed by faculty of aquaculture and marine (22%), faculty of veterinary medicine (18%) and faculty of agriculture (14%).



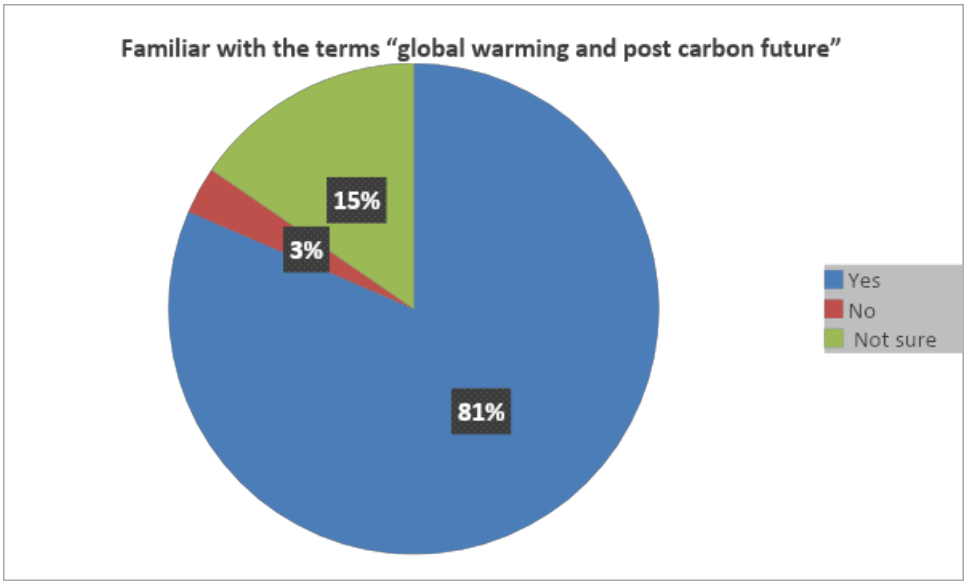
2) **Current level of education:** The vast majority of students are from undergraduate (67%) and master programme (28%). Doctorate students represent 4.1%.



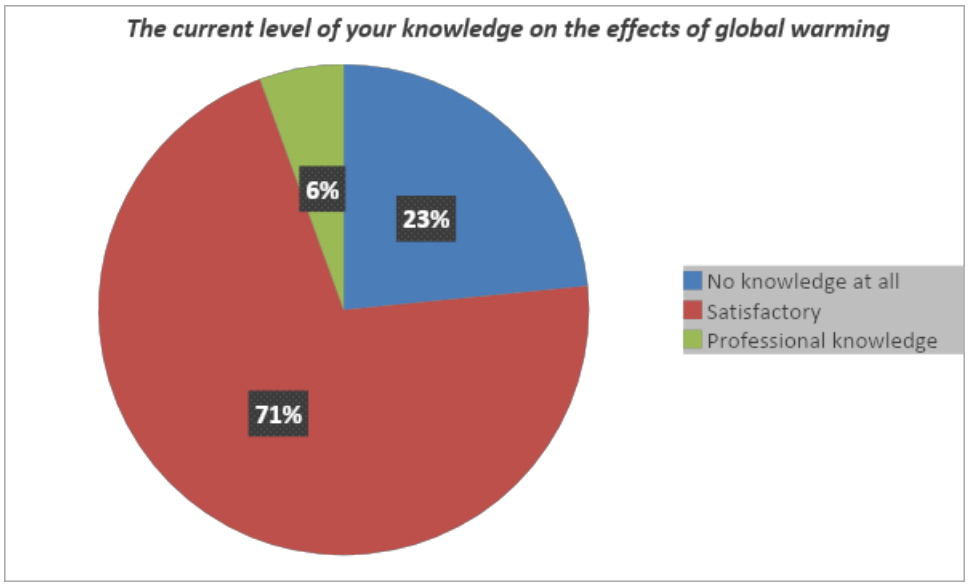
3) **Familiar with the term "Blue Carrier" :** 56% of the students don't familiar and 34% of them partly familiar with the term Blue Carrier. 10% of them don't familiar with the term.



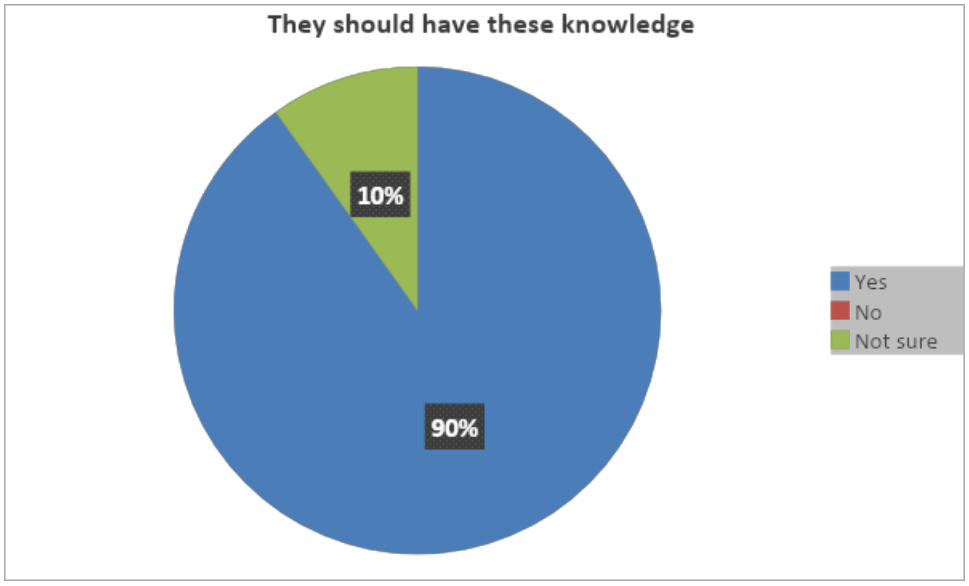
4) **Familiar with the terms "global warming and post carbon future":** Most of the respondents (82%) familiar with the terms "global warming and post carbon future", 15% of them are not sure and 3% of them don't familiar with the term.



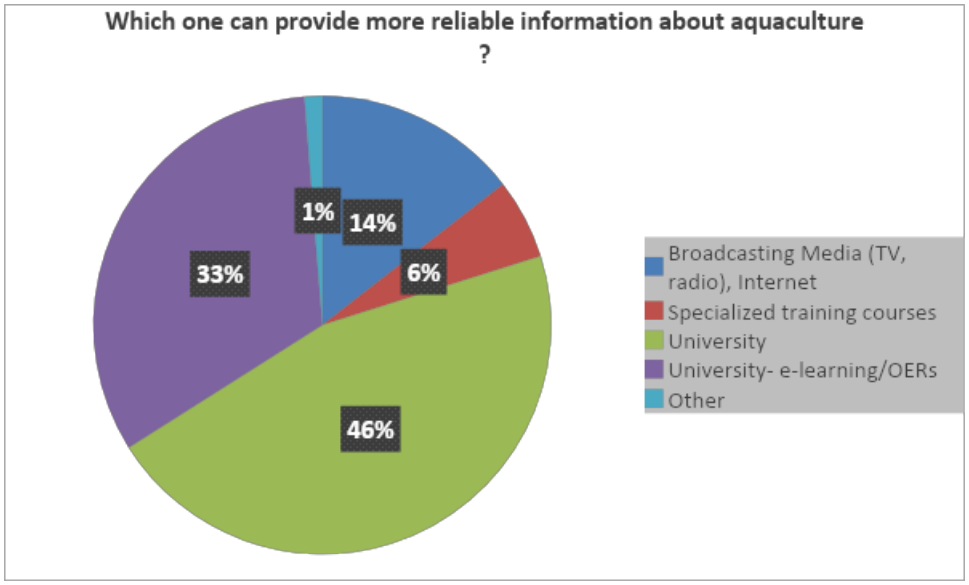
5) **The current level of their knowledge on the effects of global warming on water quality, breeding and biotechnology, feeds and feeding, breeding system selection, environmental impacts of aquaculture and disease outbreak and proactive applications in aquaculture:** 71% of the students have satisfactory knowledge and 6% of them have professional knowledge about these topics. However, 23% of the students have no knowledge at all.



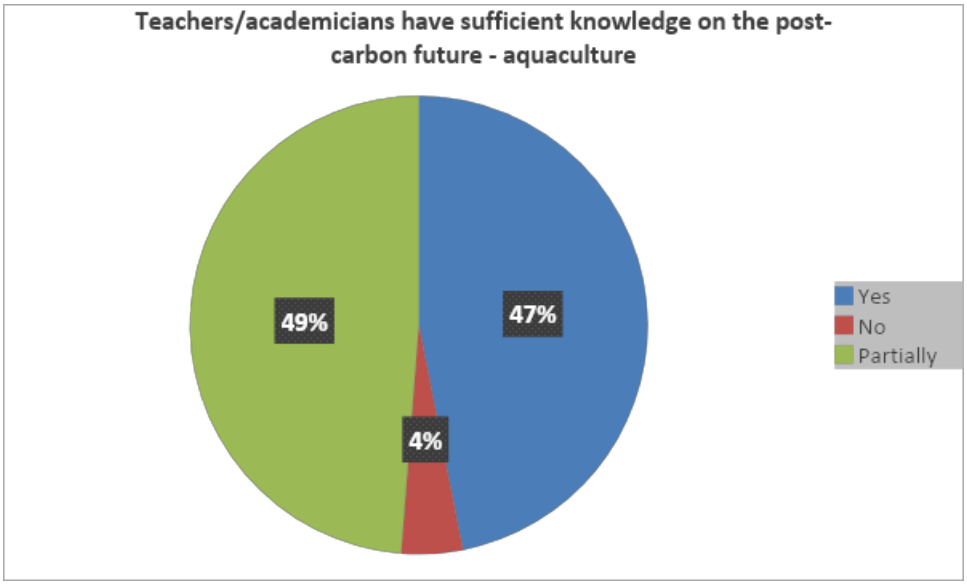
6) **Should you have these knowledge?** The vast majority of the studentss (90%) want to have these knowledge but 10% of them are not sure.



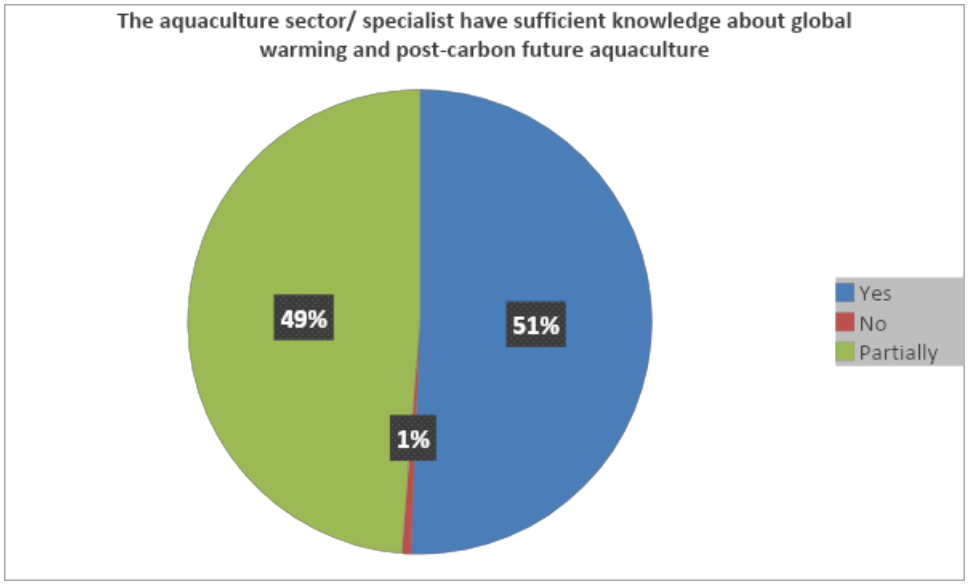
7) **Which one can provide more reliable information about aquaculture according to you?** Almost half of the students (46%) have indicated that the university can provide more reliable information about aquaculture, followed by university-e-learning/OERs and broadcasting media and internet (14%).



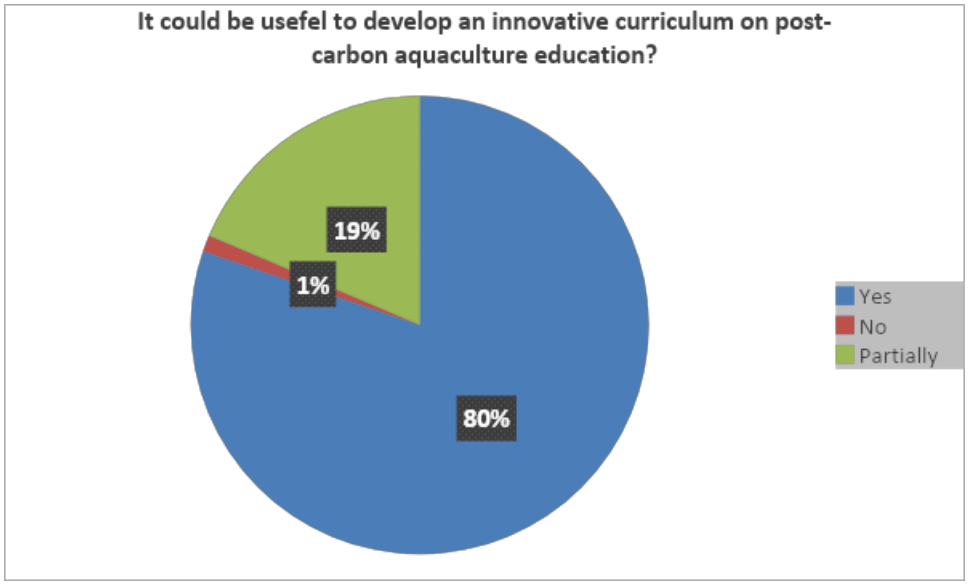
8) **Do you agree that teachers/academicians have sufficient knowledge on the post-carbon future - aquaculture?** They partialy (49%) or completely (47%) agree that teachers/academicians have sufficient knowledge on the post-carbon future – aquaculture.



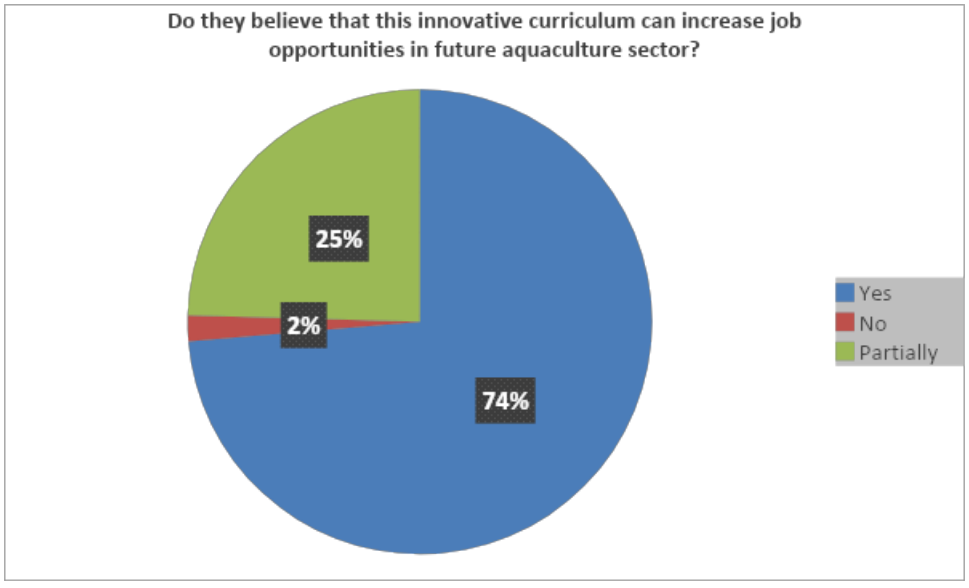
9) **Do you agree that the aquaculture sector/aquaculture specialist have sufficient knowledge about global warming and post-carbon future aquaculture?** They completely (51%) or partially (49%) agree that the aquaculture sector/aquaculture specialist have sufficient knowledge about global warming and post-carbon future aquaculture.



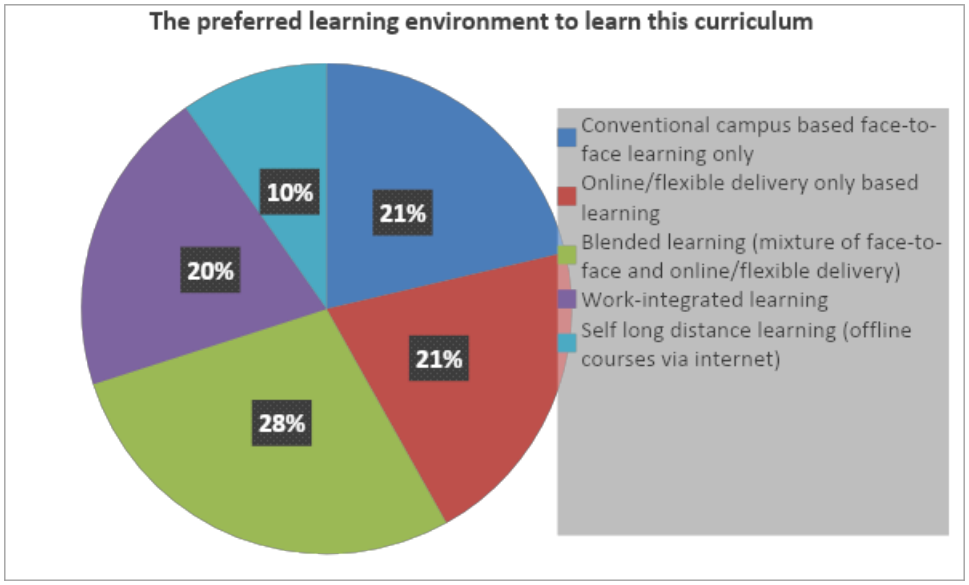
10) **Would it be useful to develop an innovative curriculum on post-carbon aquaculture for your education?** The vast majority of the students (80% completely and 19% partially) think that to develop an innovative curriculum on post-carbon aquaculture can be useful for their education.



11) **Do you believe that this innovative curriculum can increase job opportunities in future aquaculture sector?** 74% of the students completely and 24% of them partially believe that this innovative curriculum can increase job opportunities in future aquaculture sector.



12) **What is your preferred learning environment to learn this curriculum?** The students preferred blended learning (mixture of face-to-face and online/flexible delivery) (28%), Online/flexible delivery only based learning and Conventional campus based face-to-face learning only (21%) and work integrated learning (20%). However, 10% of the respondents prefer self long distance learning (offline courses via internet).



Conclusion

Academicians/Lecturers:

- DiBluCa project partners reached a total of 261 participants through the surveys they developed within the framework of SoA report preparation, reaching a total of 110 academicians/lecturers and 151 higher education students, who are among the main target groups of the project. This is above the total number of 200 participants in 5 countries for surveys in the project.
- Most of the academicians/lecturers are Assoc. Prof./Asst. Prof., Lecturer/ Research Asst.and Prof. Dr.
- The academicians/lecturers are mainly affiliated to faculties.
- The features of the academicians/lecturers teaching aquaculture courses are dominantly Prof.Dr/ Assoc.Prof. Dr./Assist. Prof. Dr. and others.
- Different faculties, faculty of aquaculture and marine, faculty of agriculture, faculty of veterinary medicine and also faculty of science provide aquaculture education at the undergraduate level in their institutions.
- Aquaculture education is mostly provided at undergraduate and master levels at their universities.
- Almost all academicians/lecturers emphasized that they needed to have skills and knowledge on climate change and post carbon future for aquaculture.

- Although academics stated that they wanted to have more knowledge and skills about all specific issues of aquaculture related to global warming in the project proposal, their priority preferences for each specific issue was different. In this context, disease outbreak and proactive applications, and breeding system selection are stated as less important issues by the academics/lecturers.
- Academicians /lecturers reported that the kind of aquaculture courses that their universities organize are mostly both elective and compulsory or elective/compulsory.
- Most of them think that the undergraduate curriculum about the climate change and post carbon future for aquaculture should have general knowledge, it may help them to be more effective in their jobs, it may help them to find new job opportunities, and it may provide them with new design and research opportunities.
- The academicians/lecturers reported that the training/education material courses provided on aquaculture in their institutions are mostly articles and similar resources, national and international text books, experiment, equipment, models, videos, artificial intelligence, etc., and e-learning. OERs materials are less used in providing training/education.
- Most of them stated that specialist courses in aquaculture at the undergraduate level or incorporate the relevant skills and knowledge into existing degree, CPE, WIL, and aquaculture courses to meet national and international needs for students who wish to work abroad should be included in the mix of content included in aquaculture courses at undergraduate and postgraduate levels in their institutions.

Students:

- The students participated in the questionnaires are mostly from different 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), faculty of aquaculture and marine, faculty of veterinary medicine and faculty of agriculture.
- Their current level of education are mostly undergraduate and master.
- The high majority of the students completely or partially don't familiar with the term Blue Carrier. However, almost all of the students are familiar with the terms "global warming and post carbon future".
- The responses showed that most of the students have satisfactory knowledge on The current level of their knowledge on the effects of global warming on water quality, breeding and biotechnology, feeds and feeding, breeding system selection, environmental impacts of aquaculture and disease outbreak and proactive applications in aquaculture. However, only few of them have professional knowledge and ¼ of them have no knowledge on this issues at all. Almost all of the students emphasized that they want to have these knowledge.
- The students think that the university and university- e-learning /OERs can provide more reliable information about aquaculture.

- They partially or completely agree that teachers/academicians have sufficient knowledge on the post-carbon future – aquaculture. They also agree that the aquaculture sector/aquaculture specialist have sufficient knowledge about global warming and post-carbon future aquaculture.
- Almost all students think that to develop an innovative curriculum on post-carbon aquaculture can be useful for their education. They believe that this innovative curriculum can increase their job opportunities in future aquaculture sector after graduation.
- The order in which students prefer to learn this curriculum is as follows: blended learning (mixture of face-to-face and online/flexible delivery), online/flexible delivery only based learning and conventional campus based face-to-face learning only, work integrated learning, and self long distance learning.

In conclusion:

- ✔ The participants, including both academics and students, have expressed a strong consensus on the necessity for enhanced knowledge and skills related to climate change, the implications of a post-carbon future, and emerging topics in aquaculture education to mitigate climate change effects. The environmental impact of aquaculture, especially concerning global warming, stands out as the most pressing issue, alongside concerns such as breeding, biotechnology, and disease management. There is, however, less demand for knowledge in breeding system selection. The majority of the survey participants stated that all six modules specified in the project proposal should be included in a new curriculum in aquaculture against climate change, but that there is an order of importance among them.
- ✔ The academics and students indicated that they need skills and knowledge about climate change, the post-carbon future and new topics in aquaculture education to mitigate the effects of climate change. The surveys pointed out that the need for a forward-thinking approach to aquaculture education. Equipping students with the knowledge and skills to navigate the challenges of climate change will be critical for the long-term sustainability of the aquaculture industry.
- ✔ A significant portion of the respondents believes that topics on climate change and envisioning a post-carbon future should be incorporated into the undergraduate aquaculture curriculum.
- ✔ The educational resources currently used include articles, both national and international textbooks, journals, and other similar materials. A notable finding is that more the vast majority of the participants are not familiar with the term "Blue Carrier," though many are aware of concepts like global warming and post-carbon futures, and there is a strong desire among the majority to acquire more knowledge in these areas.
- ✔ Therefore, it is important that the following six main modules are included in the curriculum to be developed.

Module 1. Effects of global warming on water quality and impact on aquaculture,

Module 2. Global warming and breeding, biotechnology in aquaculture,

Module 3. What should change feed and feeding in aquaculture due to global warming,

Module 4. System selection against global warming in aquaculture,

Module 5. Environmental impacts of aquaculture from global warming perspective,

Module 6. Effects of global warming on diseases in aquaculture and protective applications.

- ✔ The results of the surveys indicate a student population eager for deeper knowledge on climate change and its impact on aquaculture. They are open to innovative learning methods and see the potential for this knowledge to benefit their careers.
- ✔ Furthermore, students indicate that their universities, along with university- e-learning /Open Education Resources (OERs) could provide more reliable information about aquaculture. They also believe that an innovative post-carbon aquaculture curriculum could enhance their career prospects within the future aquaculture industry and it will increase their job opportunities in the future aquaculture sector.
- ✔ In terms of preferred learning environments, students favour a blended approach that combines face-to-face interactions with online or flexible delivery methods.

Annex 1: *Questionnaire 1 (*University Teachers / Academicians / Lecturers)

A. Demographics

1) What is your age range?

a) <24
b) 25-35
c) 36-45
d) 46-55
e) >56

2) What is your occupation?

a) Prof. Dr.
b) Assoc. Prof./Asst. Prof.
c) Lecturer/ Research Asst.
d) Teachers
e) Specialist

B. Institutions and education staff

3) What is the type of institution that you are affiliated to?

a) Faculty
b) Institute
c) Vocational High School
d) Research Center /R&D department
e) Department/Laboratory

4) What are the features of the academicians teaching aquaculture courses?

a) Prof.Dr/ Assoc.Prof. Dr./Assist. Prof. Dr.
b) General lecturer
c) Lecturers working at different faculties
d) Lecturer at some specific departments
e) Others

C. Education field level

5) Which faculty/institute provides aquaculture education at the undergraduate level in your institution?

a) Faculty of Aquaculture and Marine
b) Faculty of Agriculture
c) Faculty of Veterinary Medicine
d) Faculty of Science
e) Other (……Please specify)

6) At which levels education about aquaculture is provided at your university?

(You may select more than one)

a) Two-year degree programs
b) Undergraduate
c) Master
d) Doctorate
e) Courses

7) Do you need to have skills and knowledge on climate change and post carbon future for aquaculture?

a)Yes
b) No

8) In which specific issue of aquaculture related to global warming do you need more knowledge

and skills?

(You may select more than one)

a) Water quality
b) Breeding and biotechnology
c) Changes in feeds and feeding mode
d) Breeding system selection
e) Environmental impacts of aquaculture from global warming perspective
f) Disease outbreak and proactive applications
g) All of the above

D. Depth of education

9) What kind of aquaculture course does your university organize?

a) Elective
b) Compulsory
c) Both elective and compulsory
d) Part of a course
e) Other

10) What do you think about climate change and post carbon future for aquaculture as a topic in the undergraduate curriculum?

(You may select more than one)

a) They should have general knowledge.
b) It may help them to be more effective in their jobs.
c) It may help them to find new job opportunities.
d) It may provide them with new design and research opportunities.
e) All of the above

11) What training/education material courses provided on aquaculture in your institution?

(You may select more than one)

a) National and international text books
b) Articles and similar resources
c) e-learning courses
d) Open Education Resources (OER) courses
e) Experiment, equipment, models, videos, artificial intelligence, etc.

E) Training and education

12) What mix of content should be included in aquaculture courses at undergraduate and postgraduate levels in your institution?

(You may select more than one)

13) Specialist courses in aquaculture at the undergraduate level or incorporate the relevant skills and knowledge into existing degree

14) Specialist courses in aquaculture needed at the postgraduate level for continuing professional education (CPE)

15) Online delivery of these courses appropriate at the undergraduate and postgraduate levels

16) Work-integrated learning (WIL) courses in aquaculture

17) Aquaculture courses to meet national and international needs for students who wish to work abroad

Annex 2: Questionnaire 2 (Students)

A. Demographic

1) What is your faculty/institute?

a) Faculty of Aquaculture and Marine
b) Faculty of Agriculture
c) Faculty of Veterinary Medicine
d) Faculty of Science
e) Other (…..*Please specify*)

2) What is your current level of education?

a) Two-years degree programs
b) Undergraduate
c) Master
d) Doctorate

e) Post doctorate/Guest student

B. Global warming, post carbon future and aquaculture knowledge and education information

3) Do you familiar with the term "Blue Carrier"?

a) Yes I am
b) I partially am
c) Unfortunately I am not

4) *Are you familiar with the terms "global warming and post carbon future"?*

a) Yes
b) No
c) Not sure

5) What is the current level of your knowledge on the effects of global warming on water quality, breeding and biotechnology, feeds and feeding, breeding system selection, environmental impacts of aquaculture and disease outbreak and proactive applications in aquaculture?

a) No knowledge at all
b) Satisfactory
c) Professional knowledge

6) Should you have these knowledge?

a) Yes
b) No
c) Not sure

C) Source of aquaculture information

7) Which one can provide more reliable information about aquaculture according to you?

a) Broadcasting Media (TV, radio), Internet
b) Specialized training courses
c) University
d) University- e-learning/OERs
e) Other (……..)

8) Do you agree that teachers/academicians have sufficient knowledge on the post-carbon future - aquaculture?

a) Yes
b) No
c) Partially

9) Do you agree that the aquaculture sector/aquaculture specialist have sufficient knowledge about global warming and post-carbon future aquaculture?

a) Yes
b) No
c) Partially

D) The knowledge on post-carbon future aquaculture and job opportunities

10) Would it be useful to develop an innovative curriculum on post-carbon aquaculture for your education?

a) Yes
b) No
c) Partially

11) Do you believe that this innovative curriculum can increase job opportunities in future aquaculture sector?

a) Yes
b) No
c) Partially

E) Post-carbon future aquaculture training and education needs

12) What is your preferred learning environment to learn this curriculum?

(TICK UP TO 3 ITEMS)

13) Conventional campus based face-to-face learning only

14) Online/flexible delivery only based learning

15) Blended learning (mixture of face-to-face and online/flexible delivery)

16) Work-integrated learning

17) Self long distance learning (offline courses via internet)

Thank you very much for your kind collaboration to **DiBluCa** project!

DiBluCa Project Team

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