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Developing competences in a cross-border interdisciplinary project: student and teacher perceptions of the Ocean i3 project

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Abstract

The aim of this research was to analyse students' perceptions of the competences developed by taking part in the cross-border interdisciplinary Ocean i3 project. The objective of the Ocean i3 project is for students to acquire learning, research and sustainability competences while contributing to reduce plastic pollution along the Basque-Aquitaine coast. The project uses a Challenge-Based Learning approach in which social actors from the surrounding cross-border area propose challenges that students have to solve. The research methodology used is exploratory and descriptive; for the data collection qualitative and quantitative instruments have been used. The main result is that students and teachers perceive that the former have improved the sustainability competences engaging and working on the project. Mostly they perceive to have developed active listening, analysis, creativity and negotiation competences.

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Introduction

Universities across Europe started the reform process under the European Higher Education Area several years ago, designing and implementing competence-based curricula (OECD, 2018 and 2019). At the methodological level, the paradigm shift towards a student-centred teaching-learning model has increased the use of active methodologies in university classrooms (Fernández March, 2006; Jiménez, 2018; Jiménez et al., 2020). The concept of learning as the development of competences, beyond the mere acquisition of knowledge, means that different knowledge areas must be interrelated. As a result, the challenge is to design and implement cross-disciplinary teaching-learning projects that make this interrelation possible (Rekalde et al., 2012). Moreover, the 2030 Agenda for Sustainable Development (UN, 2015) sets out the 17 Sustainable Development Goals (SDGs) and challenges universities to incorporate the SDGs into their goals and policies (Barth et al., 2007; Corcoran et al., 2002; Leicht et al., 2018; Sáez de Cámara et al., 2021).

This university context of active learning and students' development of cross-disciplinary and sustainability competences is the focus of this research. The purpose of this research is to describe the perceptions that university students and teachers have regarding the competences developed in the Ocean i^3 education for sustainability project. The aim is to investigate the students' perception of the development of competences due to their participation in Ocean i^3 and to explore whether these contexts contribute to meeting the SDGs. However, while the study focuses on raising awareness to reduce plastic in the oceans, this challenge serves as an excuse to learn about capacity building in a collaborative project focused on sustainability.

Background to the Ocean i^3 project

Ocean i^3 is a cross-border interdisciplinary project that aims to reduce ocean plastic pollution along the Basque-Aquitaine coastline. In doing so, students from the two universities participating in the project - the University of the Basque Country (UPV/EHU) and the University of Bordeaux (UBx) - develop sustainability competences. The project creates a complex ecosystem around five key aspects: 1) Conceptual; 2) Pedagogical; 3) Institutional; 4) Territorial; and 5) Employability (Alkorta et al., 2017; Barrenechea et al., 2019; Rekalde-Rodríguez et al., 2021a). At the conceptual level, the project is understood as a socially responsible innovation that seeks a positive impact on its surrounding environment. At the pedagogical level, the Challenge-Based Learning methodological approach is followed (Gallagher & Savage, 2020; Nichols et al., 2016).This methodology is closely related to other active methodologies such as Problem-Based Learning, Project-Based Learning and Service-Learning. However, it differs in that the challenges involve finding solutions to real problems through specific actions, rather than

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solving questions or case studies designed for the classroom (ITESM, 2016). At the institutional level, Ocean i^3 is supported by the two participating universities and *Euskampus Fundazioa* (an inter-institutional instrument which manages the UPV/EHU's International Campus of Excellence). At the territorial level, social actors in the area propose challenges focussing on the cross-border environment in which the universities are located, such as reducing ocean plastic pollution. Finally, at the employability level, students develop cross-disciplinary competences, which focus on sustainability so students can adapt to what is required of them professionally in the future (Zinkunegi-Goitia & Rekalde-Rodriguez, 2022).

A community is created around the Ocean i^3 project, made up of the following teams:

- The Ocean i^3 Technical Team (OTT). The OTT's functions are to actively participate in the project concept design, facilitate relations between the universities and territorial actors, and to manage organisational and logistical aspects of the project.
- Academic coordinators (one person from each university). Their main function is to coordinate the teaching teams from their respective university and connect them with the OTT and other university structures.
- Teaching and research staff from both universities that guide the students when developing the competences and performing academic tasks.
- Students from both participating universities. Students from UPV/EHU are students in the third and fourth year of a Bachelor's or Master's degree, while those from UBx are Bachelor, Master, University Diploma or Postgraduate students. There are diverse knowledge areas, including: Business Administration and Management, Biology, Sports Science, Criminology, Law, Nursing, Chemical Engineering, Pedagogy, Psychology, Advertising, Political Sciences, French philology and Arts.
- Social actors in the area participate by proposing challenges to the students, providing information, resources and feedback throughout the work process, and evaluating the results.
- The broader community in the sense proposed by Lahneman (2010), i.e., the university community and public and private actors in the cross-border project territory that interact with the project at different points in time.

Literature

Cross-disciplinary competences

The term competence as a concept is polysemic and ambiguous, and there is no consensus on how to translate this concept to educational practice (Murga-Menoyo, 2015). Defining cross-disciplinary competences is therefore equally complex. Literature suggests that cross-disciplinary competences go beyond those specific to a professional profile, contemplating additional characteristics such as transferability, multifunctionality and multidimensionality. In short, cross-disciplinary competences cover more than specific curricular areas, and the Ocean i^3 project has integrated them into its competence map given its cross-disciplinary nature.

Research into the reality of education, as perceived by learners, is a valuable source of information for understanding and improving the complexity of teaching-learning processes; therefore, the analysis of the learner's personal view of competence development is fully justified (Segers y Dochy, 2001; Struyven, et al., 2005 cited by Robledo et al., 2015). The achievement of competences and the perception of them, as Clemente-Ricolfe & Escribá-Pérez (2013) show, are directly related in the case of cross-disciplinary competences (oral communication, written communication, knowledge of foreign languages, analytical skills, problem solving, learn to learn, time management, adaptation to new situations and autonomous work). All these competences are being developed in Ocean i^3 project, in addition to some of the project's own competences.

Ocean i^3 Project Competences

When the project competences were defined, the four competences proposed by CRUE (2012) for sustainability were taken into account: 1) critical contextualisation of knowledge by making connections between local and/or global social, economic and environmental issues, 2) sustainable use of resources, 3) participation in community processes to foster sustainability, and 4) application of ethical principles related to the values of sustainability in personal and professional behaviour. On the other hand, and based on the key learning proposed by UNESCO, Murga-Menoyo (2015) recreates a basic matrix of competences for sustainability, stressing those of: critical analysis, systematic thought, collaborative decision-making and a sense of responsibility towards present and future generations.

The Ocean i^3 project has three dimensions relating to the three "i's": *ikaskuntza* (learning), *ikerkuntza* (research) and *iraunkortasuna* (sustainability), and it has a competence map (Cruz-Iglesias *et al.*, 2022) relating these three dimensions to the ten project competences. This map (see Table 1) is the result of research into different competence frameworks for sustainable development, which included work by ANECA, 2012; CRUE (2012 and 2019); Murga-Menoyo (2015); Rieckmann (2011 and 2012); UNESCO (2015); Uranga et al. (2019); Wiek, et al. (2011).

Table 1

Competences to be developed in each dimension of the Ocean i^3 project (Rekalde-Rodríguez et al., 2021b)

Dimension	***Ocean i^3* competences**
1. Learning (i=*ikaskuntza*)	1. Communication in intercultural contexts
	2. Negotiation, horizontal participation and commitment to share results
	3. Active listening, interpretation, interrelation and interaction
1. Research (i=*ikerkuntza*)	4. Analysis, understanding and solving complex problems
	5. Creativity: problem-solving from different angles
	6. Systematicity: preparing expert reports based on research methods
3. Sustainability (i=*iraunkortasuna*)	7. Transdisciplinarity: integrating and managing knowledge by taking contributions from different subject areas and social contexts

8. Integration of SDG values
9. Overall, holistic view of problems
10. Multilingualism: dealing with a multilingual language repertoire

Likewise, in the catalogue of transversal competences of the University of the Basque Country (UPV/EHU) (Uranga et al., 2019), and taking as a reference the classification of competences of the Asia-Pacific project (Care et al. 2016) the following are specified: "*Autonomy and self-regulation*"; "*Social Commitment"*; "*Communication and Multilingualism"*; "*Ethics and professional responsibility*"; "*Information Management and Digital Citizenship*"; *"Innovation and Entrepreneurship"*; "Critical thinking*"*; and, "*Teamwork*" (see Figure 1).

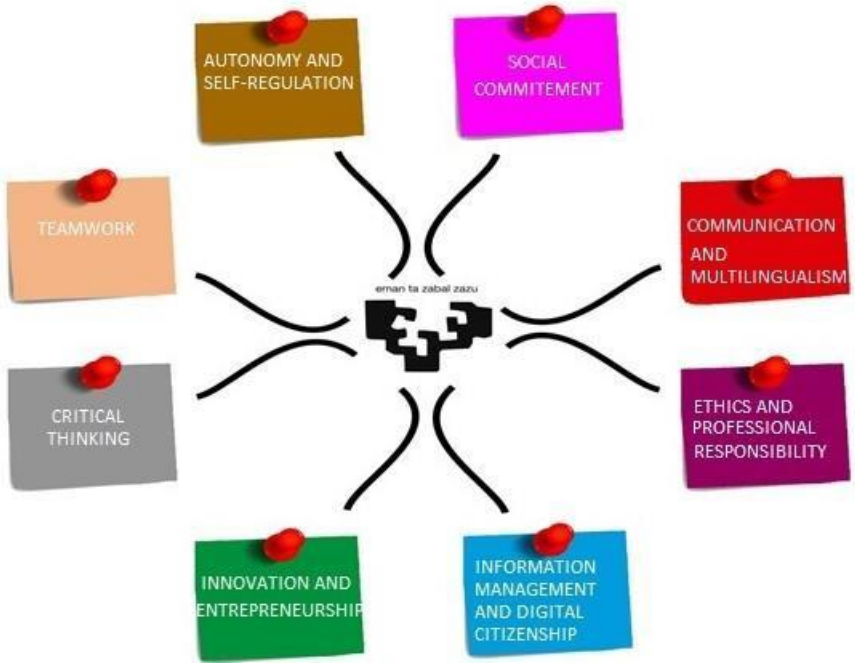


Figure 1

The Cross-disciplinary competences of the University of the Basque Country (Uranga et al., *2019)*

Universities are also tackling the challenge of implementing the actions set out in the 2030 Agenda for Sustainable Development (UN, 2015). Along these lines, the UPV/EHU has defined its 2030 Agenda Plan accordingly, which translates the 17 SDGs into 17+1 by adding a goal related to Linguistic and Cultural Diversity: "*1. No Poverty*"; "*2. Zero hunger*"; "*3. Good health and well-being*"; "*4. Quality education*"; "*5. Gender equality*"; "*6. Clean water and sanitation*"; "*7. Affordable and clean energy*"; "*8. Decent work and clean energy*"; "*9. Industry, innovation and infrastructure*"; "*10. Reduced inequalities*"; "*11. Sustainable cities and communities*"; "*12. Responsible consumption and production*"; "*13.Climate action*"; "*14. Life below water*"; "*15. Life on land*"; "*16. Peace, justice and strong institutions*"; and, "*17. Partnerships for the goals*" (see Figure 2).

The Ocean i^3 project specifically addresses the following SDGs: "*14.Life below water"*, "*6.Clean water and sanitation"* and "*4.Quality education"*.

The project also addresses SDG "*17+1.Basque language, Basque culture and plurilingual capacitation"* implemented by the UPV/EHU. It is carried out in a multilingual context where the region's language, Basque, a minority language, is given greater visibility. This is done without disregarding the ultimate aim of the project, which is to foster communications between the entire Ocean i^3 communities.

Figure 2 *Adapted from the 17+1 SDGs from the UPV/EHU's 2030 Agenda Plan*

Ocean i^3 Learning Process

Students are provided with a learning proposal where they can develop the aforementioned competences, contribute to the SDGs, and solve challenges posed by social actors. This proposal consists of five workshops (see Figure 3) which take place between January and June. The workshops are institutional didactic choreographies designed to give the Ocean i^3 community the opportunity to work towards sustainable development (Rekalde-Rodríguez et al., 2022).

The first workshop is a meeting between the extended Ocean i^3 community, students, teachers, *Ocean* Technical Team (OTT) & academic coordination, and social actors. The social actors are selected on the criteria of their direct link with the sea, seeking a balance between the sectors and allowing their scope of action to extend from the Basque-New Aquitaine region. The challenges to be worked on are defined in a collaborative way in this meeting. The approach to

tackle challenges is inspired by the model of Nichols et al. (2016) but with adjustments that respond to the uniqueness of the Ocean i^3 project. These are basically: the definition and specification of the challenges among the whole community, including the social agents (Rekalde-Rodríguez et al., 2022). In the second workshop, the proposals and activities are defined in a transdisciplinary way. The proposals are presented and debated with the social actors in the third workshop. The work proposals aimed at resolving the challenge are re-constructed in the fourth workshop, which also involves raising awareness on the impact that the work has in relation to the initial challenge and the SDGs. Finally, the results obtained are presented to the Ocean i^3 community in the fifth workshop, an event aimed to reach a wider audience where the results are also posted on social media.

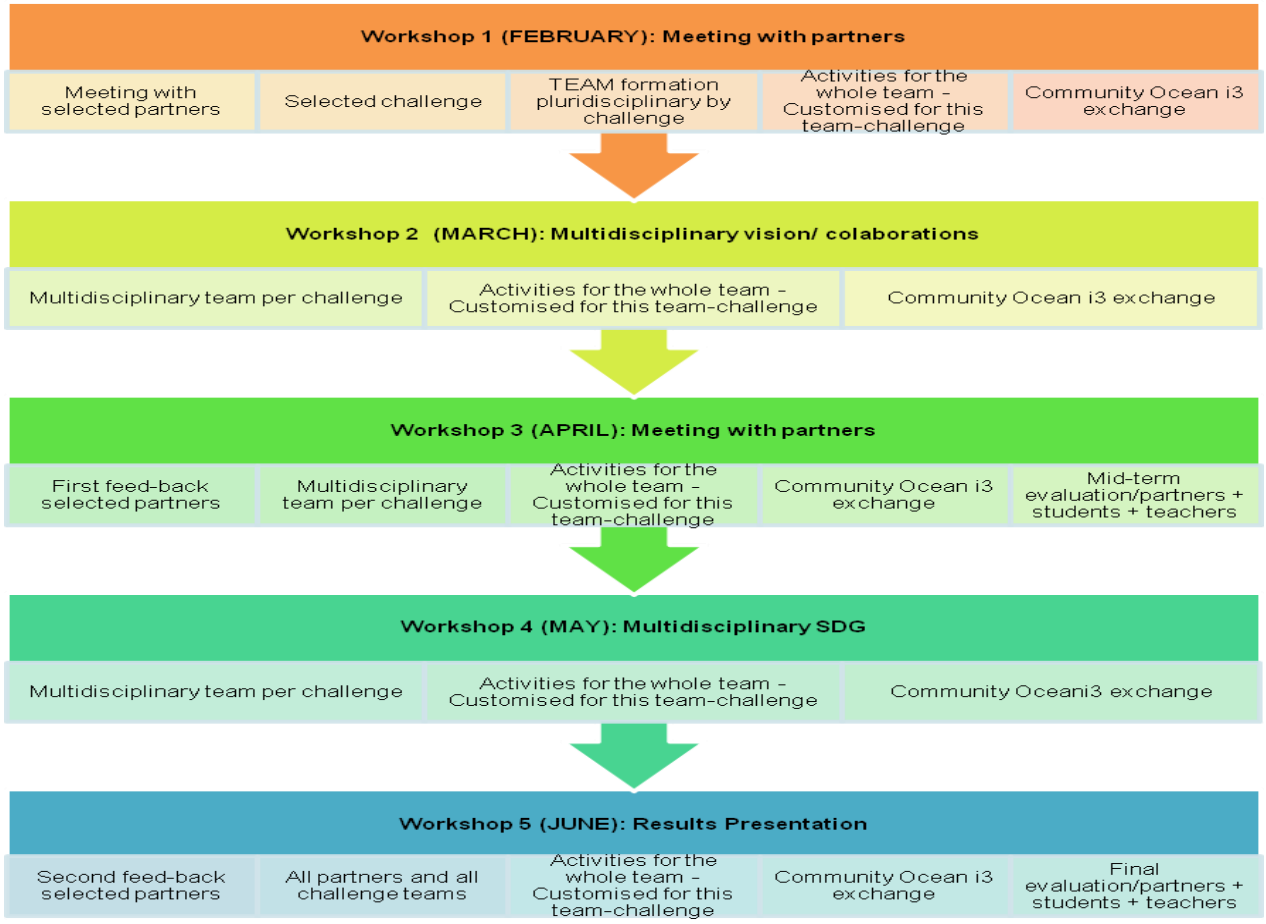


Figure 3

Timeline of the five workshops, 2021/2022 academic year (based on Authors, 2021a and adapted from Rekalde-Rodríguez et al., 2022)

Students perform other academic tasks related to their studies at the same time as the project activities are carried out (including coursework, voluntary internships, final year projects, and Master thesis), which may impact the challenge directly or indirectly (Rekalde-Rodríguez et al., 2021a).

Method

The aim of this research is to identify student and teacher perceptions on the competences developed in the Ocean i^3 project. An exploratory study of a descriptive nature was chosen for this purpose.

This methodology was adopted as the objective is to determine the perceptions that Ocean i^3 students and teachers have regarding the development of competences for sustainability, a research area which requires constant reassessment and interpretation. As noted in the literature, exploratory studies are used to increase familiarity with relatively unknown phenomena on which there are questions or insecurities to obtain information on the possibility of carrying out more complete investigations, and setting priorities for subsequent research (Ferreyra and De Longhi, 2014; Hernández et al., 2003).

The project was initially more exploratory in nature, and has moved towards a more descriptive approach in response to the information gathered. This has allowed for a more in-depth analysis of how students and teachers perceive the competences developed and the contribution to the SDGs within the framework of the Ocean i^3 experience (Sabariego-Puig et al., 2009).

Participants

A total of 46 students and 14 teachers participated in the project in the 2021/22 academic year (see Table 2). The organisations that participated as social agents direct and indirect way were: Mater, Rivages protech, Emaús, 4P Scienseas, Provincial Council of Gipuzkoa, EPOC laboratory, Mundaka City Council, Gaia, National School Sport Union, SUEZ, Kutxa Foundation, Surfrider, AZTI Member of Basque Research & Technology Alliance, and T.E.O. (see webpage: https://oceani3.com/en/inicio-english/).

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the both institutions. In line with what Blaxter et al. (2008) propose, the participants in the study were informed about the nature of the study in consideration of ethical and quality factors. Informed consent were obtained from participants, and, furthermore, voices and information were coded to preserve privacy, anonymity, personal dignity and integrity of participants.

Table 2

Participants in Ocean i^3 project in 2021/22 academic year

Disciplines	Students	Teachers
Medicine & Nursing	5	3
Ecotoxicology	3	1

Sport	5	1
Law	2	1
Education	2	2
Arts	18	3
Marketing & Advertising	4	2
French philology	7	1

Instrumentation

In tune with the aim of the research and the exploratory nature of the study, qualitative and quantitative instruments have been used.

Student tasks

Information of a qualitative nature comes from the group tasks carried out on the *Mural* digital platform by the work teams throughout their participation in Ocean *i*^{3}. Specifically, one of the tasks to be carried out in workshop 4 consisted of the students identifying and describing the competences that the project promotes and develops. This type of documents and records are common and ideal for research of this nature (Hernández et al., 2003).

The students worked in groups around the 6 challenges directly proposed by the 6 social agents to the Ocean *i*^{3} community. The distribution of students in the groups by challenge was as follows (see Table 3):

Table 3

Challenges in Ocean i^3 project in 2021/22 academic year

Challenges	**Social agents**	**Students**	**Teachers**
1. Practice water sports in a healthy and sustainable way	Provincial Council of Gipuzkoa + T.E.O.	1 Education 1 Nursing 1 Law 2 Ecotoxicology 1 Philology	1 Education 1 Nursing 1 Ecotoxicology

2. Become aware of the damage caused by plastics on the coast of Urdaibai	Gaia + Rivas Protech	1 Marketing & Advertising 1 Law 2 Sports 3 Arts 1 Nursing 2 Philology	1 Law 1 Philology
3. Get to know and get involved with the *ecopatrols*	Mater	1 Sports 4 Arts 1 Marketing & Advertising 1 Philology	1 Marketing & Advertising 1 Arts
4. Environmental care award	Mater	5 Arts 2 Sports 1 Education 1 Nursing 1 Philology	1 Education 1 Nursing
5. *Seabin Pasaia*. Collecting plastic from the sea	Mater	1 Ecotoxicology 3 Arts 1 Marketing & Advertising 1 Philology	1 Arts 1 Sports
6. If you pollute the rivers, you pollute the ocean	Surfrider	1 Marketing & Advertising 2 Nursing 3 Arts 1 Philology	1 Nursing 1 Arts

The analytical procedure followed consisted of content analysis. The nature of qualitative content analysis provides a systematic approach to discover meaning in textual data, both on the surface and implied beneath it. This study was based on the content analysis of the factors that students

attribute to the development of competences for sustainability following the recommendations of Kleinheksel et al. (2020).

Questionnaires

Two questionnaires previously constructed and validated by the *IkasGura* research team (The *IraunIK* and *IraunIR* Questionnaires) were used to collect participants' opinions (Rekalde-Rodríguez et al., 2021b). These questionnaires consider the following dimensions:

- Perception of the development of the 10 Competences for Sustainability in the Ocean i^3 Project.
- Perception of the development of the UPV/EHU's 7 Cross-disciplinary Competences (communication competence is not included because it is covered by Ocean i^3 project's own competences).
- Perception of the contribution of the work to reach the 17+1 SDGs.

Students and teachers rated each item with a score corresponding to a Likert scale from 1 to 5, with 1 being very little development and 5 being significant development. They completed the questionnaire at the final evaluation of the project (see Figure 1).

The statistics applied are descriptive in nature, in line with the research methodology. They have been used to clearly and simply summarise the results obtained from the questionnaires in the form of graphs (Rendón-Macías et al., 2016). The graphs are used to ultimately show trends in student and teacher perceptions, providing information on the objectives of this study.

In this case the study sample (see Table 4) is made up of students and teachers who completed the questionnaire at the end of the project. Exploratory studies tend to involve small samples that do not allow general conclusions to be drawn, but rather they provide insight into trends and patterns that can help future research.

Table 4

Sample characteristics

	Students	**Teachers**
N	13 people	6 people
Gender	11 female	5 female
	2 male	1 male
Average age	20.9 years old	50.7 years old
Membership	1 University of Bordeaux	1 University of Bordeaux
	12 University of the Basque Country	5 University of the Basque Country
Studies	1 Sport	1 Ecotoxicology
	1 Education	1 Education
	1 Marketing & Advertising	1 Nursing

10 Arts	3 Arts

Results

Perception of participants in Ocean i³ on the development of competences for sustainability

Below, the opinions expressed by the participants in the 4th project workshop on the competences they believe they are working on and the factors to which they attribute this development are collected.

According to the data obtained, there are four competences that all teams, connected with a challenge, claim to have developed. One of them is the competence "*1.Communication in inter-cultural contexts*". The provided arguments relate to the diversity of cultures and languages, and the pursuit of a common goal: *"Despite speaking different languages, communication is being fostered through different ways.*" (Challenge 3); " *Complementation of disciplines in different languages for a common purpose.*" (Challenge 3); "*Because we have different points of view according to different cultures*" (Challenge 4); "*We have lived with multilingualism and we have had to share ideas with people who speak other languages*" (Challenge 5).

The teams perceive that they have developed "*2. Negotiation, horizontal participation and commitment to share results*". The factors to which they relate this perception are the methodology used, the common goal, the internal collaboration between the members of the group and the external collaboration with stakeholders: "*Although each person in the group has different objectives, they come together in a group objective." (*Challenge 3);"*Each one of us has contributed to the group.*" (Challenge 4);"*We have had to negotiate in order to work together on our project.*" (Challenge 2);"*We speak in advance with the agents about their needs and we adapt our work to their request*." (Challenge 3); "*As the workshops go on, we show the progress*" (Challenge 6).

They also claim to have developed the competence "*3. Active listening, interpretation, interrelation and interaction*". The arguments provided refer to the internal collaboration between the people in the group, the open-minded attitude and the work performed by the interpreters: "*We listen to our group members and we help each other with a new perspective*." (Challenge 6); "*We are willing to take into account new ideas that can be used to carry out the project."* (Challenge 3); "*We are willing to attend to the needs of both parts of the program in an assertive way and open to adaptation.*" (Challenge 3);"*With the help of interpreting students, the interaction of people who speak different languages has been encouraged.*" (Challenge 2); "*In the small group and in the large group we all pay attention and listen*" (Challenge 5).

Finally, regarding competence "*5.Creativity: problem-solving from different angles*", the groups agree that they have developed it because of the methodology used and the interdisciplinary nature of the project: "*We have started from 0. Therefore, there has been a free creative process*." (Challenge 4); "*Each of us brings different solutions from their own field*." (Challenge 3); "*Each one has solved his part of the task from his/her discipline*." (Challenge 5); "*We have solved the problems we have had.*" (Challenge 2).

However, this unanimity does not apply to the other competences. Thus, with respect to the competence "*4. Analysis, understanding and solving complex problems*", a group claims not to have developed it because of the type of problem and the time to solve it. The groups that claim to have developed it relate to the methodology used, the communication and respect between participants: "*We have had two different challenges and we have achieved to unify them.*" (Challenge 2), "*Problems have been resolved through communication".* (Challenge 3); "*We have been able to solve problems with each other with respect and without any conflict*." (Challenge 6); "*We have use resources from our different areas*" (Challenge 3).

Similarly, this difference in perceptions occurs in relation to competence "*7.Transdisciplinarity: integrating and managing knowledge by taking contributions from different subject areas and social contexts*". A group has not developed it because *"All members belong to the same discipline*." (Challenge 4). The other groups claim to have developed it because of the common goal and the collaboration: "*Knowledge management from very different fields as a common project*." (Challenge 1); "*Each member of the team is studying a discipline and has nurtured the team with their knowledge.*" (Challenge 6); "*Each student contributes from their area*" (Challenge 5).

Regarding competence "*8.Integration of SDG values*", a group claims not to have developed it: "*At the group level, the SDGs have not been taken into account, but at the individual level they have been worked on or taken into account*." (Challenge 4). Another group shows doubts, but does not argue them. The other four groups claim to have integrated these values and to have worked extensively on SDG 14 due to the working methodology: "*The methodology takes into account the use of several different areas.*" (Challenge 3); "*We have worked extensively in relation to objective 14*" (Challenge 5); "*Specially in the care for the environment and marine life*" (Challenge 6).

This disparity of views also occurs in relation to competence "*9.Overall, holistic view of problems*". A group doubts whether they have developed it or not, and another group denies having developed it because of "*The problem proposed by the entity was very specific.*" (Challenge 4). The other four groups claim to have developed it because of the methodology used, the internal collaboration among group members, and the awareness raising done: "*Every work takes into consideration the other's work.*" (Challenge 2); "*We have been aware of the importance of the problem we were addressing.*" (Challenge 4); "*We have achieved a global vision because we have worked as a group*" (Challenge 5).

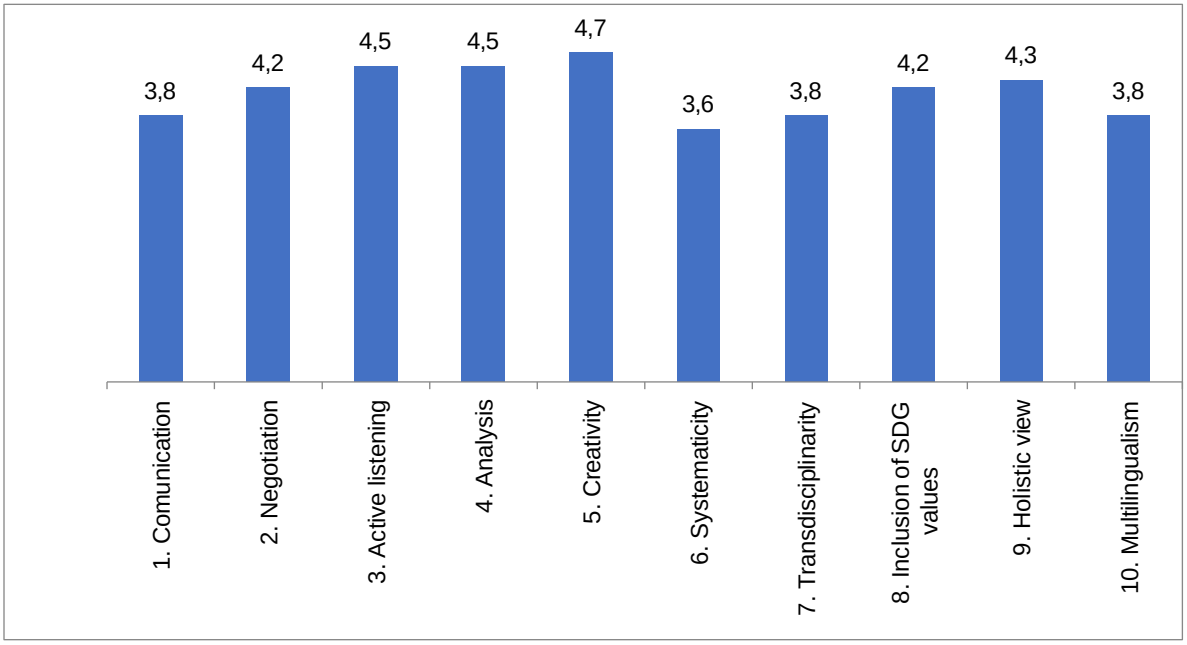
Regarding competence "*6.Systematicity: preparing expert reports based on research methods*", two groups report that they have not developed it "Because *each has used their methodology*" (Challenge 4). All four groups that claim to have systematically implemented a research method attribute this to the methodology and the existence of a common goal: "The *activities favour group work, understanding and communication among group members*." (Challenge 3); "*Objectives have been met as agreed.*" (Challenge 6).

Finally, this difference between the perceptions of the different groups also occurs in relation to competence "*10.Multilingualism: dealing with a multilingual language repertoire*". Two groups indicate that they have not developed it "*Because all members of the group were monolingual"* (Challenge 4) or "*Since most of us could communicate with only one language, there has not*

been much multilingual linguistic repertoire."(Challenge 6). Those who claim to have developed it, point to linguistic diversity as a factor, as well as the conceptualisation of this diversity as an asset and the work carried out by interpreters: "*The fluent leap of languages is encouraged, seeing richness in it.*" (Challenge 3);"*We have been able to communicate thanks to the interpreters.*" (Challenge 5).

Perception of students participating in Ocean i³ on the development of competences for sustainability

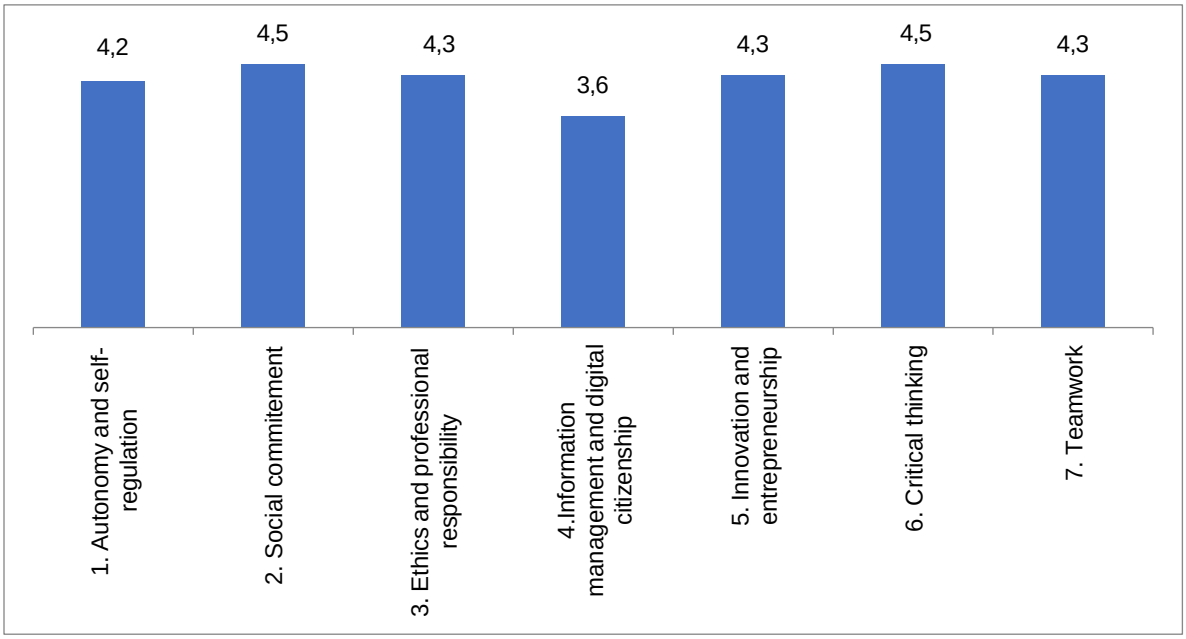
The competences that students claim to have developed the most in the project Ocean i³ are (see Graph 1): "*5.Creativity*: *problem-solving from different angles*" (average score of 4.7); "*3.Active listening, interpretation, interrelation and interaction*" and "*4.Analysis, understanding and solving complex problems*" (both with an average score of 4.5); *"9.Overall, holistic view of problems*" (4.3); *"2.Negotiation, horizontal participation and commitment to share results*" and "*8. Inclusion of the SDG values" (*both with an average score of 4.2*)*.



Graph 1

Students' perception of the Ocean i³ competences developed in the project

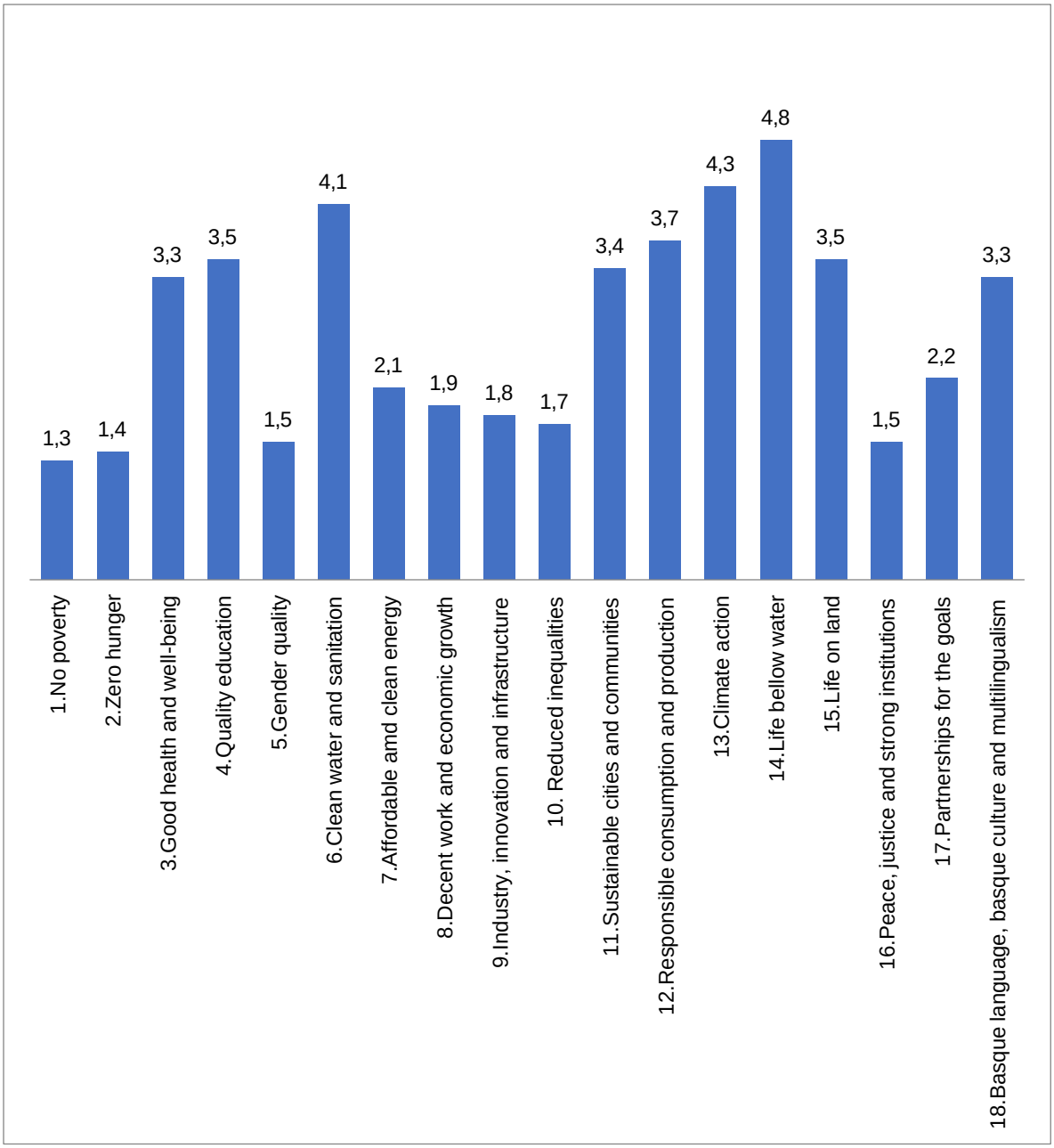
The average scores corresponding to the students' perceptions of UPV/EHU's cross-disciplinary competences are (see Graph 2): "*2.Social Commitment*" and "*6.Critical thinking*" (both with an average score of 4.5); "*3.Ethics and professional responsibility*"; "*5.Innovation and Entrepreneurship*" and "*Teamwork*" (all with an average score of 4.3).



Graph 2

Students' perception of the UPV/EHU's cross-disciplinary competences developed in the project

Finally, the students' perception regarding their contribution to the 17+1 SDGs was also sought (see Graph 3). Based on average scores for each goal, students perceived that the work performed has contributed significantly to the SDGs "*14.Life below water*" (score of 4.8), "*13.Climate action*" (score of 4.3), and "*6.Clean water and sanitation*" (score of 4.1). On the other hand, students perceived that their contribution has had less of an impact on the SDGs *"1.End poverty"; "2.Zero hunger"; "5. Gender equality"* and *"16. Peace, justice and strong institutions*" (average scores between 1.3 and 1.5).



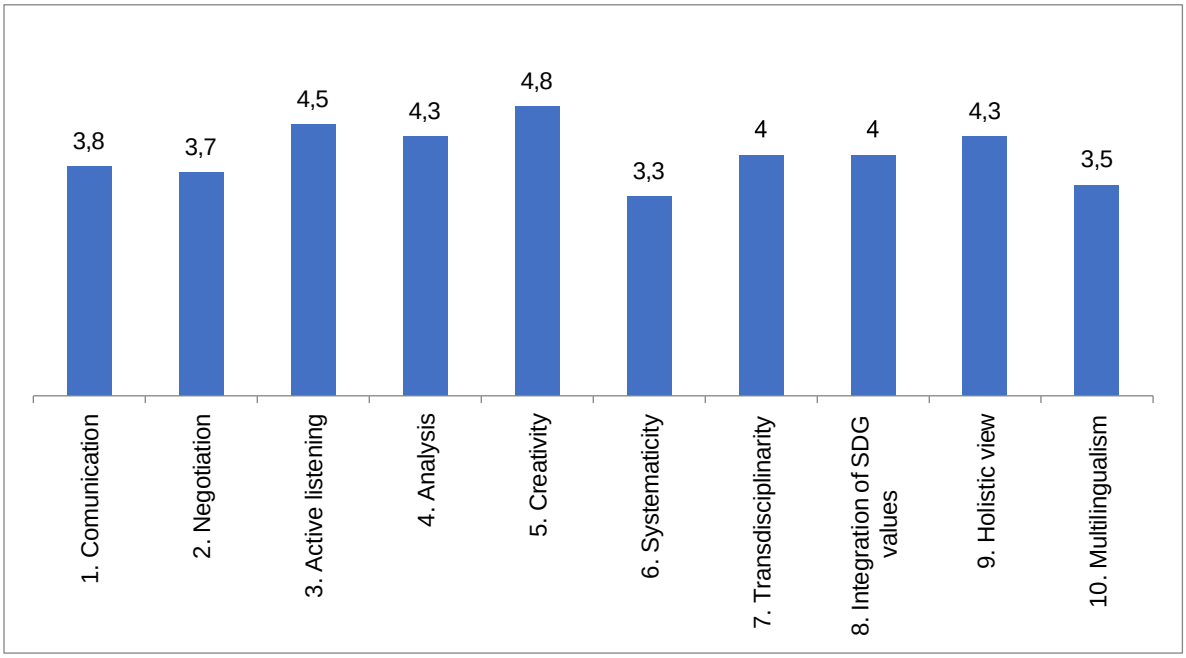
Graph 3

Students' perceptions of their contribution to the 17+1 SDGs

Teachers' perceptions of the competences developed by students participating in Oceani[3]

The teachers' perceptions on the teaching, learning and sustainability competences that their students develop by taking part in the Ocean i[3] experience are (see Graph 4): *"5.Creativity: problem-solving from different angles"* is the one that is developed the most (with an average score of 4.8); *"3.Active listening"* (4.5); *"4.Analysis, understanding and solving complex problems"* and *"9.Overall, holistic view of problems"* (both with an average score of 4.3). The competences

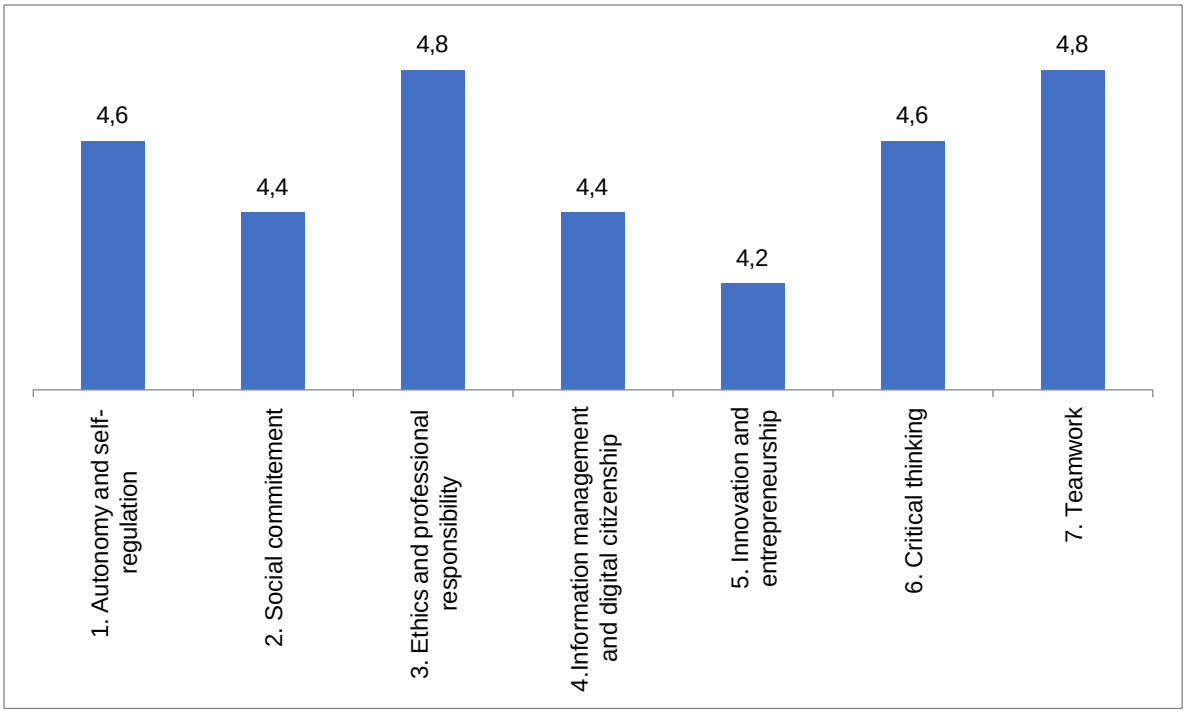
which teachers perceive students have developed to a lesser extent correspond to: "*6.Systematicity*" and "*10.Multilingualism*" (with average scores of 3.3 and 3.5, respectively).



Graph 4

Teachers' perception of the Ocean i[3] competences developed by students

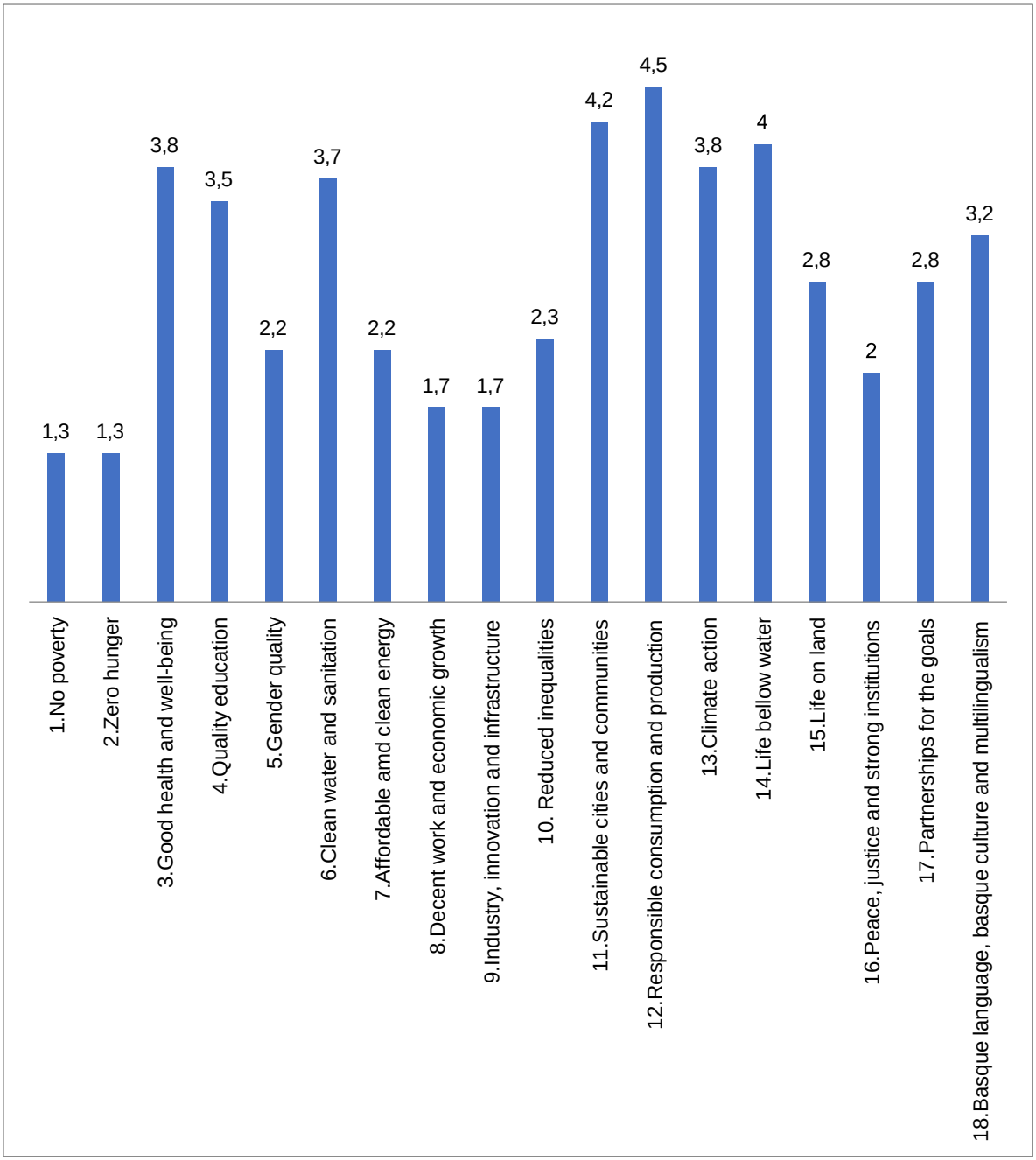
With regards to the UPV/EHU cross-disciplinary competences (see Graph 5), teachers perceive that the competences most developed by students are "*3.Ethics and professional responsibility*" and "*7.Teamwork*" (average score of 4.8). These are followed by "*1.Autonomy and self-regulation*" and *"6.Critical thinking*" (both with an average score of 4.6).



Graph 5

Teachers' perceptions of the cross-disciplinary competences (UPV/EHU) developed by students

Finally, an attempt was made to gather teachers' perceptions on the contributions students made towards the 17+1 SDGs throughout the project. Considering the average scores obtained (see Graph 6), those with the highest scores are *"12.Responsible production and consumption"* (4.5), *"11.Sustainable cities and communities"* (4.2) and *"14.Life below water"* (4.0).



Graph 6

Teachers' perception of students' contribution to the SDGs

On the other hand, teachers gave a lower score to the contribution made towards SDGs *"1.End poverty"; "2.Zero hunger"* (both with an average score of 1.3); *"8.Decent work and economic growth"*; and *"9.Industry, innovation and infrastructure"* (both with an average score of 1.7).

Discussion

This study highlights the need to investigate which competences are fostered and developed in learning environments with sustainability at their core. Evidently, this task has a series of complications, firstly because defining and specifying competences for sustainability is complex (Rieckmann, 2011 and 2012; Wiek et al., 2011). In this case, the competences have been established (Cruz-Iglesias et al., 2022; Rekalde-Rodríguez et al., 2021b) for the learning environment under study (Rekalde-Rodríguez et al., 2021a). The competences are developed through active methodologies where student involvement, participation and commitment to learning is key (Fernández March, 2006; Jiménez, 2018).

Taking into account the previous results regarding the factors that the groups in each challenge pointed out in relation to the development of the competences, it could be said that the following have been key: the methodology used (for the development of competences 2, 4, 5, 6, 8 and 9), collaboration between participants (competences 2, 3, 7 y 9), and the common goal (competences 1, 6 and 7).

Furthermore, taking into account the opinions expressed by the working groups on the different challenges, and bearing in mind the value of the perception of competences as a very useful source of information for researching the reality of Education (Segers & Dochy, 2001; Struyven, et al., 2005 cited by Robledo *et al.*, 2015) are competences "*1.Communication in inter-cultural contexts*", "*2.Negotiation, horizontal participation and commitment to share results*", "*3.Active listening, interpretation, interrelation and interaction" and "5.Creativity: problem-solving from different angles*" which the students in the working groups perceive themselves as having developed. These results match with those obtained through the questionnaire, as the skills of negotiation, creativity and active listening were three of the most highly valued by both students and teachers. This is in line with the literature regarding the value of the active methodologies (Jiménez et al., 2020) and, specifically, about challenge based learning (Gallagher & Savage, 2020), as well as the own context of Ocean i^3 Project (Rekalde-Rodríguez et al., 2022).

In addition, both students and teachers perceive the contribution towards SDGs "*14.Life below water*", "*6.Clean water and sanitation*" and "*4.Quality education*" to be among the highest following the Ocean i^3 project, which is conceived in response to the UPV/EHU's and the UBx's position on sustainability and respect for the oceans. However, they are not the only competences to be developed, as very high scores are given to SDGs, which do not explicitly form part of the project's objectives: "*3.Good health and well-being*", "*11.Sustainable cities and communities*", "*12.Responsible consumption and production*" and "*13.Climate action*". The interdisciplinary nature of the project and the way in which varying challenges are tackled by different scientific disciplines can lead to more SDGs being addressed than those originally envisaged (Cruz-Iglesias et al, 2022).

Conclusion

This paper concludes that:

- The students and teachers that took part in the Ocean i^3 learning environment for sustainability perceived that their development of all project competences has increased, as has the development of the UPV/EHU's competences.
- Students and teachers have been able to reflect on the contribution of their actions, activities, proposals and work towards the development of the SDGs.
- Students' perceptions of their development of Ocean i^3 and UPV/EHU competences are higher than those of teachers.
- In contrast, teachers' perceptions of the project's contribution towards the 17+1 SDGs are higher than those of students are.
- Both students and teachers perceive that the competences of creativity, active listening and negotiation are the most developed through participating in Ocean i^3 project.

It is clear that, in this type of challenge-based teaching, student participation is key, but also the incitement to learning that the teaching staff and those who stimulate the collaborative work sessions carry out. True involvement is achieved through the responsibility that is generated with the challenge, and with the people collaborating in the group, hence the group work around the different challenges shows different results.

In the light of the reflections arising from the results and conclusions, we can highlight the following suggestions for teaching practice:

1. Education for sustainable development has an ambiguous, flexible and changing nature, and it becomes a challenge for the university community. A conscious and planned approach to the SDGs is essential.

2. The development of competences for sustainability in university students is a responsibility assumed by higher education institutions, but they do not always know how to respond to them. This paper describes the working process that aims to contribute to this development.

3. The design of challenging scenarios for the development of competences for sustainability requires the creation of an enlarged community to be involved in this work (teaching staff, students, social agents, university administration, etc.).

4. It is essential to collect the participants' perception of the development of competences for sustainability through quantitative and qualitative instruments, for their further contextual interpretation.

5. The contribution to the SDGs of the activities carried out within the enlarged community and the academic own activities of university students (Final Degree Projects, Master's Degree Projects, classroom projects, internships, etc.) must be highlighted and given value through research.

The study had several limitations, including: 1) limited sample size, where voluntary rather than compulsory participation in the research was prioritised; 2) lack of representation for students and teachers from UBx, largely due to the differences in academic calendars; and 3) teachers'

perceptions were only collected at the end of the workshops, because the teachers did not know the initial competence level of the student, and indeed might not know the student at all.

With regard to further studies, we propose a dual approach of competences. On the one hand, the aim is to carry out a longitudinal study on the development of competences in Ocean i^3. On the other hand, based on the identified competences, we intend to measure the perception of the community, taking into account students, teachers and social agents, in relation to inclusion in learning environments for sustainability.

In addition, the socio-environmental impact of the individual work that students carry out during their participation in the project is another area to be addressed.

Finally, this study highlights the path to be followed for learning environments by putting sustainability performance into practice while monitoring competences so students can be able to face the sustainability challenges posed by the 21st century.

We would like to end this article by pointing out that experiential learning that is genuinely situated in real life is much more impactful, meaningful and long lasting than learning that is simulated within university walls. However, the implementation and sustainability of the project takes time, dedication and effort on the part of all involved. Above all, in the case of the teachers who choose to carry out regular internships connected to the real problems of the planet and society, and whose work is not always recognised and valued by the academic institution. The results support us in saying that continuing to work along these lines benefits the development of competences in sustainability and the implementation of methodological strategies aligned with education for sustainable development.

Conflict of Interest

The author(s) disclose that they have no actual or perceived conflicts of interest. The current study has not obtained funding. It has been developed under the auspices of *IkasGaraia*, a consolidated research group of the Basque Government (IT1637-22).
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