

Ocean Connections Pilot 1 Evaluation

National report SPAIN

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Introduction

This draft report synthesises learning from the initial data collection for the ES Pilot 1. It should be noted that although the pilot was completed as originally planned, some data collection was completed online rather than in-person, as a result of the COVID-19 pandemic.

Pilot 1 was conducted with 135 pupils in the 11-14 age group, across seven classes in O Cruce School: one class in Year 6 primary and two classes in Secondary year 1-3. Each group participated in a project planned using the Ocean Connections educative principles, though the curriculum focus differed between groups. Table 1 shows the project groups and topics.

Year group	Number of students	Project title
Year 6 Primary	1 class of 25 pupils	Responsible Predator
Year 1 Secondary	2 classes; 42 pupils	Shoaling fish; What type of fish do you eat?
Year 2 Secondary	2 classes; 26 students	Bioproducts of marine origin
Year 3 Secondary	2 classes; 42 students	Shoaling fish

Each class participated in an aquarium visit to Aquarium Finisterrae and completed activities around their specific project focus that required them to use digital tools to support their learning in line with the educative principles. In the 'responsible predator' project, pupils engaged in creative scientific inquiry using secondary sources to explore questions and communicate these ideas with posters made from recycled materials. They also collaborated to create a computer game to consolidate their learning. The 'Shoal of Fish/What type of fish do you eat?' project included a visit to a Fish Market alongside the aquarium visit, then some scientific inquiry using secondary sources to explore the fish and once again create a poster to communicate their ideas creatively, this time using an Augmented Reality digital tool, drawing on the educative principles of pupil creative use of the digital tools. The Bioproducts of marine origin project involved pupils engaging with a virtual fish dissection laboratory and use of a 3D simulator in which they explored the behaviour of fish. Pupils also created infographics and conceptual maps of bioproducts following their prior investigations.

Data was collected by four class teachers, the headteacher of the school, and a researcher from CESGA. Data sources include a pre-post questionnaire, pupil focus group interview, field notes and photographs. There were fewer responses to the post-questionnaire, which was set for pupils to complete at home, where some students did not complete it due to its similarity with the pre-questionnaire. 101 pupils completed the pre-questionnaire, and 92 completed the post.

The report is laid out according to the different strands of evaluation undertaken, the questions framed within each strand, and relevant themes identified within the data. These themes are driven by both the educative principles underpinning the project (see IO1: State of the Art Synthesis Report) and emergent themes that arose during the piloting of the projects.

STRAND 1: Evaluation of pupils' outcomes in terms of learning about, and attitude to, Ocean Literacy

1a. What do pupils learn about OL through engaging in the pilot projects?

Within the educative principles identified for the project were four core strands of ocean literacy common to the curricula of England, Denmark and Spain:

1. Humans and the Ocean are inextricably linked
2. The Ocean supports a great diversity of life and ecosystems
3. There is one big Ocean
4. The Ocean is a major influence on weather and climate

The pre-questionnaire in Spain was filled in by the students when some of the project-related activities had already started, so their answers in the questionnaire show this previous knowledge: questionnaire data must therefore be interpreted with caution. At the time the students completed the pre-questionnaire, they already showed a strong conscience about environment protection. However, some of their answers in their post-questionnaire show their acquisition of concepts and attitudes towards ocean life directly related with the activities carried out: minimum size for species, the important role of marine predators, many species of marine life (primary school students), as well as physical notions of marine water PH and density (secondary school students). For example, "Que para coger los peces del mar hace falta que tengan una talla mínima" ([I learned that] to get fish from the sea, they need to have a minimum size). These relate most closely to the principle 'The Ocean supports a great diversity of life and ecosystems'. In addition, pupils had learned how to use different types of technology and practising English language and noted some of the uses they might make of their learning elsewhere, "Medir densidades, temperaturas, as propiedades fisicoquímicas da auga, disecionar un peixe, a facer presentación que me sirven para facer mais traballos na miña vida" (Measuring density, temperature, water physical-chemical properties, virtually dissecting a fish, make presentations, which is useful for other school assignments).

In the post questionnaire, when asked how much they had learned from the project, 52% of cohort one of the Spanish students reported medium learning and 40% reported they had learned a lot. "Ecosystems" was mentioned directly or indirectly by many students in describing what this learning involved. They reflected on how things are connected, also referring to pollution, plastic etc. The many different species in the ocean was also an issue mentioned.

The questionnaire analysis also shows that on OL knowledge checking questions the Spanish cohort (101 pre- and 92 post-) showed some knowledge in relation to key OL questions, with an average 49% correct response rate across 8 questions on the pre-questionnaire and a positive improvement on these scores for 6 out of the 8 questions which focused on aspects of Ocean Literacy studied.

The Spanish cohort also showed some learning development pre-/post- in relation to questions about eating animals from the Ocean, which relates to understanding the connectedness of humans with the Ocean. A similar proportion of students (approx. 80%) answered that “Some populations of ocean animals are declining, so people should choose carefully which to eat”. Spanish students’ shifted from 43% strongly disagreeing that it was OK to buy bluefish tuna, to 53% strong disagreement with this statement, though the number of students who disagreed with the statement that ‘it doesn’t matter because the tuna is dead’ fell from 44% to 27% suggesting some mixed understanding.

Overall, there were positive comments from students as to their learning on the project, e.g. “in this project I learned more” (FG, Sp1, p1); “it’s the first time when I’ve put my attention on the fish and environment. (FG, ESP1, pg 4). The evidence in this pilot suggests that pupils’ learning focused on two of the four Ocean Literacy aspects included in the Ocean Connections educative principles: that **humans and the oceans are inextricably linked**, and that the **Ocean supports a great diversity of life and ecosystems**. In relation to the former comments which showed their learning in this area included: “The materials we throw into the ocean how they pollute, etc. this includes papers, bottles etc.” (FG, Sp1, p1); “we have to care more about the ocean. We throw so many plastics, we don’t care as we should. We have to help animals, not to pollute the ocean.” (FG, Sp1, p2). In relation to the ocean supporting diversity, students showed greater understanding of species inter-relationship: “I thought predators were bad, but now I think predators are good, because they control the marine ecosystem” (FG, Sp1, p1), derived directly from playing a game rather than direct instruction: “In this game you had to put, for example 3+4 and one fish has the result, and if it is the right size for that species, the predator can eat the fish”. (FG, Sp1, p2). Students also gained other factual knowledge from the aquarium, “because there were a lot of fish with information about the fish and we read it and we learned” (FG, Sp1, p5), and from their VR experiences, as demonstrated in IMG_1744.



Working on placing different marine species in a VR environment. (Photo, 2020_02_19/IMG_1744.jpg)

Students showed much less evidence around learning that **There is one big Ocean; although one student did show some learning around how the Ocean is a major influence on Weather and Climate**: I also learn how we are polluting the ocean, because it helps to set the Earth’s correct temperature and it gives us energy, food...It is important in our life (FG, Sp1, p4).

1b. What impact does engaging with the pilot projects have on pupils’ attitudes to the Ocean, and to environmental responsibility?

[Data sources: Semi-structured focus group interviews with pupils; Questionnaire]

From the questionnaire data, there is no clear statistical impact – comparing pre and post - in the items asking about perceived importance. However qualitative data from both pre- and post- questionnaires shows that students find those issues quite important. Due to issues in the timing and completion of the questionnaires, the findings are used solely descriptively without conducted significance testing.

In the pre-questionnaire, 85% (86 out of 101) felt issues like air/water pollution and climate change were important, with none finding it not very important. Spanish students saw importance rooted in: concern for the future in softer terms (53%); concerns for the future in survival terms (28%); an urgency to act (10%); and personal importance (3%). There was little change in this data in the post questionnaire. In this sense, data from both questionnaires and from focused interview is consistent in their concern about the subject, without being too specific in the dangers derived from it. It may be due to the activities focus on very specific concepts (animal species, role of predators, etc.) rather than general concepts of environmental dangers, marine litter, etc. Besides, we have to take into account that the pre-questionnaire was filled in when these students had already started working in some activities of the project.

Spanish students' perception of recycling and environmentally friendly products from the pre-questionnaire was that 80% (80 out of 101) found it very important, and 1% not very important. The most common reason given for this being important from 44% of the listed responses was a number of various reasons behind improving living conditions for both humans and animals in the planet. Again, there was little change in this data in the post questionnaire. In this sense, all students indicate their concern with these issues, with different degrees of concern (73% to improve living conditions, and 21% fearing the consequences if not taking measures). When responding to questions regarding how often they talk with their families about environmental issues, the dominant choice was only a few times and this fell slightly from the pre to the post questionnaire, from 58% indicating they spoke with their family a few times, and 18% every week, dropping to 51% and 16% respectively.

Pupils focus group data showed that they were clear that they felt that they had learned “many things about the ocean”. Their discussion suggested that they learned mainly about waste recycling and care: “not to throw things into the ocean, not to fish more than you can fish (overfishing).” (FG, Sp1, p2); “we have to care more about the ocean. We throw so many plastics, we don't care as we should. we have to help animals, not to pollute the ocean.” (FG, Sp1, p2); throwing things to the beach, but now we recycle in the different bins, yellow bin, green bin, etc.” (FG, Sp1, p2).

In the focus group they also discussed the danger of extinction, how “I knew that there were some animals in danger of extinction. But now I know more” (FG, Sp1, p1)

1c. To what extent is this impact (on learning/attitudes) maintained over the short and medium term?

[Data sources: Semi-structured focus group interviews with pupils]

There was only one comment which hinted at a long term contextual impact of the project. In relation to the OL diversity of life principle, one student said: “I like the project, because we learned so many interesting things about the Ocean, and I want to work more about the ocean, because I want to study marine biology, so for me this project is very fun and interesting” (FG, Sp1, p3).

Strand 2: Evaluation of pupils', teachers' and aquarium educators' perspectives on the innovation (combination of digital technology and creative pedagogies for teaching OL)

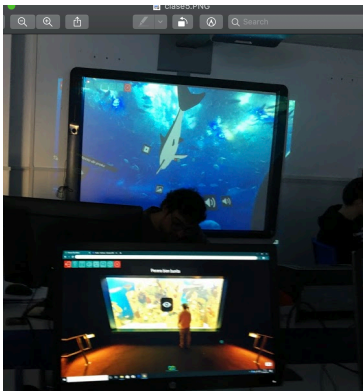
2a. What are participants' (pupils, teachers & aquarium educators') perspectives on the effectiveness or otherwise of the combination of creative pedagogies and AR/VR to teach Ocean Literacy?

While the questionnaires did not focus directly on this question, students open responses indicated their perspectives that good things about the project included: the ICT/creative apps/videogames, the visit to the aquarium, cooperation/activities, speaking English. Spanish students, like the English, felt that they had too little time on the project, and one mentioned that they didn't think was really studying.

The focus group showed no real evaluation in response to this question, but there is evidence that the creative and digital pedagogies were combined. For example: “We made a powerpoint about the predators in the oceans, and a videogame for the kids” (note: students from level 1 primary school*) (FG, Sp1, p1). More advanced use of technology and VR can be seen in this quote, and the two images below: “Yes, it was easy, but sometimes it was hard to program, because I don’t do this all day, it’s something different and all that. But I learned so many things!” (FG, Sp1, p2)



(Ph, Sp1, 2020_02_19/IMG_1761.jpg)



(Ph, Sp1, C5)

Students also commented on enjoying these approaches and finding them “very interesting” (FG, SP1, Pg2), and “more relaxed.”, and “fun”, compared to usual classwork done sitting down where “you are bored” (FG, SP1, Pg5). One student did comment on technology assisting learning “because with technology we can search fish, and we can see a photo at the moment, in one second. It’s very fast” (FG, SP1, Pg5). And another found the approach “better” but wasn’t sure if that was just their propensity for computers or whether it applied for all learners. This is perhaps reinforced by research fieldnotes that noted: “Creativity in this activity came by the hand with technology. Although the activity proposal was the same for all, the results were different, according to their preferences, skills and process”. (FN, Sp1, 2020_03_10/2ndSecondary/2ndSecondary/Field Notes_Oceans_2ndGrade.docx pg 2-3). This perhaps suggests that the technology offers a greater diversity of responses to fuel creativity.

2b. What are participants' (pupils, teachers & aquarium educators') perspectives on the affordances and barriers of the combination of creative pedagogies and AR/VR to teach Ocean Literacy?

Some students in the focus group saw ICT as offering greater affordances beyond being able to draw or paint your own images: "I think you can do better things, to search in Google or Internet a photo, and you copy it (FG, SP1, Pg6), and another saw creativity in software such as powerpoint: "you have to do creative things, for example make a nice powerpoint, a beautiful powerpoint, so be creative is important to do that (FG, SP1, Pg6)". There is an interesting tension here though between more closely student-developed project artefacts such as paintings or drawings, and images copied from the web or built into powerpoints which might appear more 'professional'.

There was no doubt that, at times, the technology presented problems, described here by one student: "the hardest was to explain the recipe and recording the video. Because at the beginning it was so bad, so we had to try one time, another time..." (FG, SP1, Pg6); and another: "ICT is useful to learn about technologies, but it takes so long to produce a material like this in AR, I'd rather do it as a powerpoint", other students nodded" (FG, SP1, 2020_03_10/3rdSecondary/Field Notes_Oceans_3rdGrade.docx pg 2)

2c. Would teachers/aquarium educators use these creative pedagogical approaches/technologies either separately or together, in the future?

This question will be more strongly answered in the final report, following the final teacher/aquarium educator interviews. However, it is clear from the teachers' extension of their use the VR tool from the Oceans pilot projects to other project, and it's use by teachers in the school not engaged in the Oceans pilot project, that teachers are keen to continue to use the Oceans VR tool in their future teaching. For example, the tool has already been used in cultural heritage projects: <https://vr.ocean-connections.net/view/1591759826936>; <https://vr.ocean-connections.net/view/1591954110518>

Strand 3: Evaluation of the implementation of the educative principles

3b. During the projects, where and how did the features of creative and digital pedagogies within the educative principles manifest?

Within this pilot there was evidence of six of the 19 educative principles, drawn from across the key fields that the Ocean Connections project connects under the umbrella of Ocean Literacy. In relation to Science in Society, **modelling** was captured in relation to how to use the VR (Workshop for students 2020_02_19/img_1760.jpg). Modelling is a term regularly used in relation to science to explore how scientists develop and use models to explore the world, explaining observations and framing hypotheses. It is also a pedagogical tool, used to refer to the demonstration of a particular skill or method. A third possible use of the term is to refer to the creation of physical or virtual models. The use of modelling in this image is primarily in the context of the second and third of these, with the teacher modelling (demonstrating) the VR in which 3D objects can be created. There is potential to use this modelling in the first sense, which is the sense in which it is encapsulated in the educative principles with respect to science and society, though it is not clear from the data whether the pupils learned OL principles through using the VR tool to create scientific models in this way.

A number of features of creative pedagogies manifested in the projects. **Transdisciplinarity** was seen when students combined "creating and explaining recipes to learn about fish and local traditions (video, SP1, 2020_02_19/IMG_1739.mov). **Ethics and Trusteeship** came through as students discussed the negatives of polluting the ocean within the focus group: "The materials we throw into the ocean how they pollute, etc. this includes papers, bottles etc" (FG, Sp1, p1); and how some were profoundly struck by a fish which was still alive at the fish market when the rest were dead, raising questions about our relationship with and impact on life in the ocean: "The fish market also made an impression.[...]The fact that they were visiting a place where fish were dead, but one was alive made an impression" (FN, Sp1, 2020_03_10/2ndSecondary/1A_Secondary/Field Notes_Oceans_1stGradeA.docx pg 2). Of the **Risk, Immersion and Play** principle, play was evidenced in hands on spherifications experiments (see image below), as well as in digital and gaming elements of the project:

Comentado [MOU1]: Image not included here And also is this what is meant by modelling. I seem to remember that this was a technical term from the Danish curriculum but maybe it can be applied to VR use too?

Comentado [2]: Reply to Microsoft Office User (28/10/2020, 15:38): "..."
Picture found. I will attach it to the report. Modelling can be also referred to 3D objects creation, so it would make sense when dealing with VR, yes.

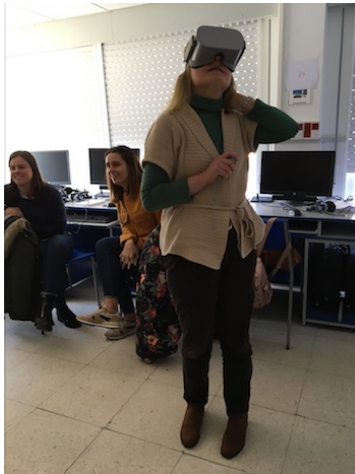
Comentado [MOU3]: Again not sure exactly where movie is

Comentado [4]: Reply to Microsoft Office User (28/10/2020, 15:41): "..."
Found. I will attach it to the report



Students create spherifications, like fish eggs, in the lab.
(photo, Sp1, 2020_03_10/2ndSecondary/IMG_20200310_164802.jpg)

The researcher's fieldnotes articulated the excitement that this playful approach engendered: "Kids excitement when they produced the spherifications in the liquid. They introduce their hands, play with the little round balls. Giggles. Teacher tells them to stop producing more, as they would keep on doing this enjoying activity for a longer period. (FN, Sp1, 2020_03_10/2ndSecondary/2ndSecondary/Field Notes_Oceans_2ndGrade.docx). It is not clear from the data whether this playful experience stimulated creative thinking for the pupils. Pupils also enjoyed the digital aspects of the projects: "We made a powerpoint about the predators in the oceans, and a videogame for the kids" (note: students from level 1 primary school*) (FG, Sp1, p1), and the researcher identified the excitement and immersive feeling of VR when experienced by both adults and children alike, (see image below), though again it is not clear in the data the extent to which this immersion in an experience and sense of fun prompted creative thinking on the part of pupils and teachers.



Piloting teachers experiencing the app for the first time.
(Photo, 2020_02_19/IMG_1771.jpg)

Co-creation was also evidenced as can be seen in the photo below where shows students creating in pairs a videogame to learn about fish minimum sizes (Photo, Sp1, 2020_03_10/6thPrimary/IMG_20200310_134947.jpg)



The photo also evidences **students as producers**, a key educative principle within the use of digital pedagogies, as does the following quote: “We made a powerpoint about the predators in the oceans, and a videogame for the kids” (note: students from level 1 primary school*) (FG, Sp1, p1)

Emergent Themes

Two key themes were identified in the data that were not captured in the specific research questions and educative principles discussed above. There are ‘Care and Responsibility’ and ‘Language Learning’.

Care and Responsibility

One theme that emerged from the data that was not derived from one of the Ocean Literacy principles that are the focus of this project was students’ awareness of threats to the ocean. One student said: “I think we are nothing responsible, because we only have to see the data. You are scared because it's incredible” (FG, Sp1, p5). This perhaps reflects some of the more emotional or affective angles that students might take in relation to the OL principles which are stated relatively neutrally.

Language learning

Another emergent theme was learning about the Ocean in another language where the videogame pushed them to learn new terminology. One student commented: “because some words we don't know but it's ok and we can practice English” (FG, SP1, Pg3). And another stated: “When we had to explain the activity, some words we can't say, because we don't know, and we have to express other things, but now in this projects, we know more words and we are explaining better” (FG, SP1, Pg3).

Conclusions and Implications for Ocean Connections Pilot 2

In the Spanish initial round of piloting, the pupils engaged with some science-focused work that related most closely to the OL principles ‘humans and the Ocean are inextricably linked’ and ‘the Ocean supports a great diversity of life and ecosystems’. Evidence from the focus groups suggests that the pupils learned some key ideas in terms of their scientific understanding linked to these principles, though the questionnaire data does not show strong patterns of learning with respect to Ocean Literacy which might in part derive from the fact that the piloting had begun before the pre-questionnaire was administered meaning that limited interpretation can be drawn from these results. However, the findings show that the pupils’ sense of care for the Ocean was strongly felt, and that this aspect of their learning through the Ocean Connections project, rather than learning about the science underpinning the OL principles, was key. This can be related to the



notion of ethics and trusteeship within the creative pedagogical features, and the emotional and affective dimension to learning. **In Pilot 2, and within the toolkit, the Ocean Connections team might consider the extent to which this emotional, affective, care-related aspect of Ocean Learning could be explored within learning about Ocean Literacy through creative, digital pedagogies. In particular, to what extent could both creative and digital pedagogies working in tandem using the VR tool foster pupils' affective engagement with the Ocean in Pilot 2. To what extent does this engagement impact on their learning about the OL principles themselves?**

In this pilot, the use of digital technologies was strongly foregrounded and seen positively by both pupils and teachers. There was a sense in which the digital tools were used to facilitate a creative response from the pupils, as well as support their learning about the Ocean, though the relationship between these two aspects of the educative principles **could be more strongly foregrounded in pilot 2, for example in extending the modelling potential of the VR tool in terms of both science and arts.** The Spanish pilot enabled substantial engagement by the **students as producers with the digital tools, which could be further capitalised on in pilot 2. The synthesis of the different aspect of the educative principles could be more explicitly planned for in Pilot 2, rather than the overlaps and relationships becoming more strongly apparent in retrospective analysis.**

Key:

SI – Staff Interview
FN – Field Notes
FG – Focus Group (Pre or Post)
IPh – Interval Photograph
APh – Affective Photograph
VT – Video transcription
VS – Video still capture
VRS – VR still capture