

Ocean Literacy and Youth – Integrating a Place Based SDG 14 Intervention into Irish Secondary School Curriculum

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CoDesRes: Co-Designing For Resilience in rural development through peer-to-peer networks and STEAM place-based learning interventions

Abstract

The United Nations Sustainable Development Goals (SDGs) were established in 2015 and are goals set for 2030 to tackle some of the greatest challenges society and our environment currently face such as climate change and poverty. As part of the EPA funded project CoDesRes: Co-Designing For Resilience in rural development through peer-to-peer networks and STEAM place-based learning interventions; research was undertaken from November 2018 to March 2019 with 67 Transition Year (TY) students (ages 15-16years) in the Iveragh Peninsula undertaking a new place based marine module consisting of six double classes (80minutes) focused on the United Nations Sustainable Development Goal 14: Life Below Water. In general ocean literacy and awareness of SDG14 was low in this coastal classroom setting and in every class given students learnt something new. Majority (65%) of students enjoyed learning in the outdoors, interactivity, active learning and peer-to-peer learning was often remarked on positively. Students enjoyed learning about their place and the interconnectedness of the ocean and land and local jobs connected with the sea. Eco anxiety was evident within 91% of the students. Only 34% of students talk about environmental issues with peers or family. 75% of the students said they think they can make a positive difference and 60% said they are already trying to have a positive impact. Recommendations are made on how to integrate ocean literacy and SDG 14 into secondary curriculum in order to create a more ocean literate population that understands the value of the ocean.

1. Introduction

As part of the EPA funded project CoDesRes: Co-Designing For Resilience in rural development through peer 2 peer networks and place-based STEAM learning interventions research was undertaken with Transition Year (TY) students undertaking a new place based marine module focused on United Nations Sustainable Development Goal (SDG) 14: Life Below Water, from November 2018 to March 2019. The Transition Year Programme (TYP) is a unique one-year programme that promotes the personal, social, vocational and educational development of students beginning to

prepare them for their role as autonomous, participative and responsible members of society [1]. The United Nations Sustainable Development Goals (SDGs) were established in 2015 and are goals set for 2030 to tackle some of the greatest challenges society and our environment currently face such as climate change and poverty. The 17 SDG's are a call for action by all countries to promote prosperity while protecting the planet. They recognize that ending poverty must go hand-in-hand with strategies that build economic growth and address a range of social needs including education whilst also tackling climate change and environmental protection [2]. Currently within the Irish curriculum there is little focus on real life challenges such as climate change or environmental health and minimal exposure to the UN SDG's. In order for the Goals to work and be met we must all collaborate to build awareness, understanding and action.

It is extremely important for us to understand the ocean and the role it plays in our lives so that we can try to help the ocean maintain a healthy balance. Human health is inextricably interdependent on a healthy ocean. Aswell as providing most of the oxygen we breathe, regulating climate and providing food, jobs and life saving medicines, ocean organisms are playing an important role in the Covid pandemic, as a bacteria found in the depths of the ocean has enabled rapid covid testing[3].

SDG 14 has 10 targets that encompass a broad range of ocean themes from sustainable fisheries and extraction, preventing pollution, protection and conservation to legal frameworks and working with communities increasing ocean literacy. This project inherently raised awareness of SDG 14 and some of its targets through the content of the lessons the TY students were engaged in during the course of the research we conducted.

2. Literature Review

It is evident that ocean literacy and an understanding of the value of the ocean and SDG 14 are low in many countries[4,5,6,7] including Ireland. To be ocean literate is to have 'an understanding of the ocean's influence on us and our influence on the ocean' as described in the Ocean Literacy Guide developed by scientists and educators [8]. Being an ocean literate citizen can mean the difference in

making informed and misinformed decisions and behaviours that can influence the health of the ocean. Involvement in environmental education is identified as being one of the main influences in environmental action [9, 10].

In 2007, Ireland generated 1.2% of GDP (€2.4bn direct and indirect Gross Value Added) from its ocean economy, supporting about 1% of the total workforce and has plans to double the value to 2.4% by 2030 as indicated in the Harnessing Our Ocean Wealth report an integrated marine plan for Ireland [11].

Even though Ireland is an island nation with over 40% of the population living within 5Km of the coast there is currently little to no marine careers or ocean science related aspects or topics in the Irish secondary school curriculum.

Whilst there are some marine elements in Irish primary school curriculum through the government funded Explorers Education Programme and Green Schools Marine Stewardship module there is very little ocean or marine topics in primary or secondary school curriculum. Unless an external independent authority/organisation/institution visits the school students have very little opportunity to understand the ocean's influence on us and our influence on the ocean.

In the Irish Transition Year (TY) a broad educational experience is offered to students. One main objective of TY is to increase student maturity, before further studies and/or vocational preparation. TY helps to offer students a bridge to make their transition from a highly structured environment to where they will have to take greater responsibility for their own learning and decision-making[1]. Transition year is a good academic year to trial and introduce new subjects/modules, as the criteria and curriculum is more flexible and offers opportunities to explore important real world challenges and subjects such as environmental education and ocean literacy.

The relationship between creativity and innovation and its influence on engaging great minds in research and problem solving has long been recognized [12]. In addition, the Arts can also disseminate STEM knowledge in a more accessible manner by 'making connections between diverse ideas and provoke unexpected conversations '[13]. This is particularly important for the needs of a twenty-first Century post-disciplinary education system and employment. Distinct knowledge domains and specialisation will always have a place in education, there is a real need to embrace exploration and experimentation. No single field or discipline can adequately meet the needs and challenges of contemporary society within the Century of the System [14]. Learning occurs at the intersection of science, technology, engineering, arts and maths in STEAM, transforming how we know and investigate the world. As a pedagogical innovation, the STEAM agenda offers an approach to teaching and learning that 'encouraged and facilitated unorthodox methods and strategies'[15] Conceptual and physical opportunities for trans and interdisciplinary research and education are created with STEAM. New ways of

thinking can be brought about by posing different questions based on knowledge exchange and insights from different ways of knowing and exploring the world. One way of exploring the world is through place based learning. Active learning and low intensity movement contributes to engagement and can thus be used as a motivating factor in the learning process[19]. A study undertaken in Sweden [19] observed the use of the outdoor environments can be made easier through digital tools. Teachers interviewed also said that there are advantages when the learning environments in the classroom are brought closer to the learning environment in the outdoor space. What the students work with indoors can be related to outside and vice versa [19]. "Outdoor education is an approach which aims for learning in an interaction between experience and reflection based on concrete experiences in authentic situations." [19].

The 'Place-based learning is learning about place, through place, for place' [20]. Participants in place-based learning feel enhanced connection to and engagement with their place [20]. People's attitudes and behaviour in relation to heritage and environment can be impacted through participation in place based learning however it was also recognised that support from another body or environmental organisation is needed to help facilitate people taking action on local issues [20].

Eco-anxiety is reportedly on the rise [16]. One of the recommendations from psychologists dealing with people who suffer from eco-anxiety is to talk about the issues with family, parents and peers [16]. From environmental psychology research, elements of both green and blue space were identified as significant in showing how nature emerged as a significant component of healing environments [17,18].

This paper presents findings on ocean literacy and awareness of SDG 14 in a coastal classroom setting. The paper also presents students preferred learning styles, environments, challenges and obstacles and their connections between their psychological well-being and environmental issues and lack of communication and real information. This paper concludes with pedagogical recommendations for the next stages of integrating these important SDG's, specifically SDG 14, into the Irish transition year school curriculum.

3. Methods

The Co-Designing for Community Resilience project was located within the Iveragh Peninsula, defined as Rural Area 5, 6 Marginal and Highly diversified, this represents 'an almost "post-agricultural" rural economy with areas of high natural amenity, attracting high levels of tourism and recreational usage, and in some cases high levels of non-farming residents who have immigrated.

We worked with Coláiste na Sceilge, a co-educational community college with an enrolment of 550 students and offered the CoDesRes curriculum from Nov 2018- March 2019 with the Transition year

students (67 students) aged 15-16 years old. We had three double classes (80mins) per week to teach a 6 wk SDG 14 module. For the delivery of the classes we incorporated as much outdoor inquiry based learning as possible and also use of indoor environment to prepare and reflect. Focus was on STEAM subjects and global/ocean stewardship with a place based approach to create systemic understanding of the ocean in place based context creating connections, understanding value and the influence terrestrial conduct actions can have on coastal areas and further offshore and how that may in turn affect us.

CoDesRes operates a bespoke critical praxis for Creative Placemaking, a systemic arts-led situated approach to placemaking while leveraging the momentum around the 2030 agenda to embed resilience and resistance through education and community toolkits. It integrates social, environmental, and equitable economic concerns within arts-led actions and place-based STEAM education (Science, Technology, Engineering Arts, Maths) to develop local improvement that acknowledges more than human needs. Through encouraging creativity and imagination *CoDesRes* contributes to a localised exploration of a de-growth economy; addressing social, environmental, and economic inequalities while maximising well-being and happiness through non-consumerist means. As an operating system, the 'role' of the pCr praxis presents an Open Source resilient approach to Creative Placemaking that encourages a triad of capitals – social, environmental, and economic, to be integrated into the process as a means to cultivate the creation of conditions towards a healthy resilient eco-socio-cultural ecosystem.

Ocean literacy programmes delivered to primary schools helped inform this research. The Explorers Education programme funded by the Marine Institute enables work with primary schools usually children aged 10yrs+, in this programme the objective is to increase ocean literacy and the wonder children have for the sea, connect them to the ocean and the realisation that we are all islanders. To measure ocean literacy knowledge a quiz is taken at the beginning of working with the students and also at the end of the module projects to understand the increase in OL within the students. This programme is mostly mixed methods of delivery (presentations, hands on biofacts discovery, outdoor seashore safaris) and project based working with students in Kerry.

Another programme that informed this research was The Volvo Ocean Race Champions for the Sea programme which was an online programme available for teachers and educators to download and use with their students, this again was mixed methods in delivery including active learning, projects and challenges. There was also an ocean literacy quiz for the teachers to use. Building on from an ocean health programme for primary school children 'Volvo Ocean Race online curriculum' Topics 2, 3 and 4:

Topic 2. Ocean Connection and Ocean Plastic Pollution

Topic 3. Ways to Reduce Plastic Pollution

Topic 4. My Positive Plastic Footprint

The intention was to build this into four topics with a youth and place-based focus with the topics below:

- Topic 1 Ocean Connection
- Topic 2 Threats – Ocean Plastic Pollution
- Topic 3 Ways to reduce Ocean Plastic Pollution
- Topic 4 My Positive Plastic Footprint – Innovation and Solutions

The new TY modules inspired by the Volvo Ocean Race and Explorers Education programme were created specifically for youth with a place-based focus. As much active outdoor inquiry based learning as possible was integrated and also use of the indoor classroom environment to prepare and reflect for each of the lessons was integrated.

Six SDG 14 lesson plans were developed specifically for this research with the Transition year students:

Lesson 1. Intro to Ocean Connections involved a pre lesson quiz, students group work to list the importance of the ocean and a video on ocean literacy to practice active listening. This lesson aims were to:

- develop understanding about the importance of the ocean
- have an increased awareness about how the ocean influences and impacts our lives
- have an increased awareness about how humans influence and impact the ocean
- practise active listening skills
- paraphrase information and record specific data
- work autonomously and as part of a group
- reflect on ideas, thoughts and opinions and give constructive feedback

Lesson 2. Ocean Connection involved mapping our ocean connections in the classroom through our relationships with the ocean in work, life etc. Students were able to

- activate their schema on ocean connection and importance

- connect human action to negative effect on the ocean and its ecosystem
- develop awareness of how our actions are connected to the ocean and its ecosystem
- develop their inquiry and critical-thinking skills to brainstorm positive action to affect change
- work as part of a small and larger group
- reflect on ideas, thoughts and opinions and give constructive feedback

Lesson 3. Interconnectedness and Biomimicry students learnt about how we influence nature and nature influences us through biomimicry. We then took some time outdoors near the ocean to map the interconnectedness of life on land in relation to the ocean. Students were able to:

- understand the interconnectedness of humans, the land and the ocean (especially from a systems perspective)
- understanding human impact on the ocean
- develop their observation skills
- develop their inquiry and critical-thinking skills
- work autonomously and as part of a group
- work creatively looking at nature and how can imagine a product useful to our life

Lesson 4. Introduction to marine pollution in the ocean and understand SDG 14.1 target better. Different sources of pollution with a focus on plastic pollution, how it reaches the ocean, where it comes from how we can all be a positive intervention. Building on from lesson 2 and 3 Interconnectedness and Nature Inspires students will have an increased understanding of how inextricably interconnected we are and how we can also have a detrimental as well as a good effect on the ocean. We will re-introduce the idea of mindfulness - how we can be mindful in certain moments and understand how it can influence our choices and how we can help stop pollution. This lesson involved a presentation on marine pollution, a walking debate and also a sorting litter game.

Lesson 5. Introduction to local coastal pollution and ocean stewardship. Different sources of pollution what is it where could it have come from. Investigative and inquiry-based learning for SDG 14. Involving presentation and mockumentary of the life of a plastic bag followed by a local beach clean and reflection.

Lesson 6. SDG14 web quest. Using inquiry-based learning using Internet searches and research watch

video and answer questions to re-instate the learning from lessons 1-5.

3.1. SDG 14 practical assessment

A time bound practical case study on marine operations and the presence of the United Nations Sustainable Development Goal 14 within their websites was also undertaken in conjunction with our practical research work with TY's.

The desk-based research was carried out in September 2018 and again in August 2019 assessing 74 different international marine operations for evidence of the United Nations Sustainable Development logo SDG 14 within their online presence. A marine operation consisted of marine activity and education centres and organisations, ocean conservation organisations or marine research centres.

4. Results

The qualitative and quantitative analysis was undertaken on 3-2-1 feedback received from TY students for each of the six SDG14 lesson plans. At the end of each class the students were asked to feedback on:

- 3 things they learnt
- 2 things they would like to know more about
- 1 opinion/thing to improve in the class

We worked with 3 TY classes and a total of 67 students, having had feedback from all students for 100% of all classes we would have had 402 feedback forms but due to attendance records we only had 44% of class attendance with 176 feedback accounts throughout the duration from November to March. Only one class completed the pre and post ocean literacy quiz due to absenteeism (pre intervention 12 students 67% correct, post intervention 21 students 72% correct answers). However, throughout the intervention delivery there was lack of awareness and clear lack of systems thinking and how everything was connected. Every class students were learning something new- that they had not heard of or been exposed to before.

Table 1. 3-2-1 Feedback data analysis by class

Responses	Outdoors Presentations	Group work Computers	Individual work	Interactivity	
Liked	65%	33%	15%	30%	7%
Indifferent	28%	39%	84%	70%	93%
Disliked	7%	7%	0	0	0
					2%

From the 3 TY classes of a possible 402 responses to each, we had 176 responses to 3 things you learnt,

158 responses to 2 things you would like to know more about and 177 opinions on the classes. Four students disliked the Lessons 1 and 6 in 4B. 123 students responded they liked the SDG14 interventions. One hundred and fifty students responded that they had learnt something new.

Note: In many of the Lessons we did not have full attendance as students had other activities and classes scheduled. Therefore, our feedback numbers are always lower than the actual student class number in most instances, this also could have been due to non-participation in feedback but the majority of students were happy to participate and fill in the 3,2,1.

The Lesson 1 - Our Ocean Connections was part spent inside the classroom and outside the school, there were 19 responses from 33 feedback forms (56%) from students that they liked the lesson. (*Note: Like was interpreted when feedback said I liked the class, I enjoyed the class, it was cool, it was 'class!', I loved it! etc*). Two students from Class 4b did not like the lesson. Six students liked the outdoors element and two students from class 4a and 4c did not like the outdoors element. Both group work and individual work in this class was enjoyed equally with 6 students feeding back that they enjoyed group work, 1 student from class 4a did not like the group work and 6 enjoyed individual work. 3 students wrote that the class was fun and 2 students like the interactive element of the class. Thirty-two students (97%) said they learnt something new in Lesson 1.

Lesson 2 Ocean Interconnectedness - We received feedback from 49 students of which 26 students mentioned that they liked the lesson (53%). 14 students mentioned they liked the outdoors element of the class with the majority of class 4c enjoying the outdoors (62% of class 4c). Eight students mentioned they liked and 3 students mentioned they disliked group work in Lesson 2. Three students mentioned they like the individual work task. One student mentioned this class was fun. Forty-eight students said they learnt something new (98%).

Lesson 3 Biomimicry - we received feedback from 44 students overall. Thirty-five students mentioned they liked the class (80%). Ten students mentioned they liked the outdoors element to this lesson. Four students mentioned they liked the group

work. One student mentioned it was fun. Six students really liked the interactivity with the live animals in the classroom. Four students also mentioned they liked the presentation. Forty-four students said they learnt something new (100%).

Lesson 4 Ocean Pollution - we received feedback from 33 students overall with 29 students indicating that they liked or enjoyed the lesson (88%). Five students mentioned they liked the outdoors and 2 students mentioned they disliked being outdoors for this lesson. One student mentioned they liked the groupwork in this class. Seven students mentioned they liked the interactive element. 100% of the students said they learnt something new in this class. Lesson 4 involved a walking debate with questions directed at understanding the beliefs, emotions and actions of the student study group when relating to ocean health issues.

A total of 44 students were involved in the walking debate from the 3 classes. One hundred percent of the students involved in the walking debate believed that there was over 8million tonnes of garbage entering the ocean yearly, they had also previously been told this in the Lesson 4 presentation. Sixty-eight percent of students believe that yes there could be more plastic in the sea than fish by 2050, 14% did not know if this was true and 18% said they did not believe this was going to happen. 91% of the students said they were afraid of what their life and the environment might look like in the future 2 students said they did not know and 2 students said no they were not afraid of how the environment and their life might look in the future. Eighty-two percent of students believed they could make a difference, only 2 students felt powerless and 7 students felt that they might be able to make a difference sometimes. Sixty-six students believed they were already making a difference and 32% said they were not making any difference and 1 person felt they were sometimes. Half of the students use a reusable bottle. Only 7 students actually talk about the environment and environmental issues with their family and peers (16%) Nine students said they sometimes speak about these issues and 66% of students said they do not talk about environmental issues with their family or peers. Half of the students at some time had helped in a beach clean or tidy towns event and 64% of the students said they sometimes pick up rubbish if they see it on the ground. 86% of

Table 2. Walking debate results from Lesson 4

QUESTION	YES	SOMETIMES	NO
Do you believe there is that much (8 million tonnes per year) plastic pollution entering the Ocean every year?	44	0	0
Do you believe that there could be more plastic than fish in the Ocean by 2050?	30	6	8
Are you afraid of what the environment and our life might look like in the future?	40	2	2

Do you believe you can make a difference?	36	7	2
Are you already starting to make a difference?	29	1	14
Do you use a reusable bottle?	22	13	9
Do you speak about environmental issues like climate change, marine pollution with friends or family?	7	9	28
Have you ever helped a Tidy Towns group or Clean Coasts group?	21	0	23
Do you use a reusable shopping bag?	38	2	4
Do you pick up litter when you see it on the ground?	6	28	10
Do you try to Reduce Reuse Recycle?	31	7	4

the students said they use a reusable shopping bag and 70% said they do try to reduce, reuse and recycle.

Lesson 5 Beach clean and Mockumentary - We only worked with class 4a for this lesson. 70% of the class said they learnt something new and 80% of the class said they enjoyed/liked the class.

Lesson 6 SDG14 WebQuest online - We lost a lot of attendance to this lesson to other activities we only received feedback from Class 4b. 60% of the students liked the class 90% said they learnt something new.

4.1. SDG 14 practical assessment results

From the 22 operations in Ireland none of them showed the SDG 14 clearly on their websites. However, most of the operations were actually supporting SDG 14 in some format through their marine education and outreach programmes or onsite facilities.

Of the 74 marine operations only four operations had evidence of SDG 14 on their website. Two global (Volvo Ocean Race + MOOC) one US based (NAMEPA) and one EU based (EMSEA) operation showed evidence of SDG 14 on their website in 2018. In August 2019, another assessment was undertaken, 72 of the operators assessed the year before still had an online presence, one operation had changed branding and name. Of the four operations that had evidence of SDG 14 on their websites only one remained evident with SDG 14 online, that was The Ocean Race Learning programme page equivalent of the year prior, the other websites may have had new content and were not focused on disclosing SDG 14 logo at the time of assessment of their website. One Irish operator had updated their website to include the SDG 14 logo on their website however there is no explanation of what the logo means on the website.

5. Conclusions

In every class the students learnt something new, this was always a high percentage (97-100%) indicating that many students had not been taught

anything about the ocean or their connection with the ocean even though they were a coastal community. None of the students said they had heard of SDG 14 prior to our intervention. Also, the practical assessment of SDG 14 presence shows the extreme lack of unified messaging and communications of UN SDG 14 which may be one of the challenges in peoples knowledge of the SDG's and could be one reason students have not heard of SDG14 previously as it is not communicated well through different platforms and operations. Although many operations are working on these important ocean health themes within their operations, they did not show the logo or mention the goals within the text of their website online at the time of this research.

It was evident from this research students enjoy both group work and individual work but mostly mentioned group work as being enjoyable. Students very much liked the interactivity element of a class as well as some mentions for the presentations being good. Opportunities for outdoor time in a lesson was mentioned by a high number of students as enjoyable.

Eco-anxiety is on the rise and is very evident within this TY with the high percentage (91%) of students that said they were afraid of what their life and environment might look like in the future. One of the recommendations from psychologists dealing with people who suffer from eco-anxiety is to talk about the issues with family, parents and peers however it is evident from our study that 66% of the students said they do not talk about environmental issues with their family or peers.

As a small Island nation with over 40% of our population living within 5km of coastline and we need to be ocean literate to understand all the ocean offers, health, wellbeing, food, jobs, energy and to understand how we need to protect this valuable resource.

One of the lessons enjoyed by most students and which there was a big element of surprise was when mapping our connections with the ocean and how we are so linked and the people we know are linked to the ocean which showed how the students had not thought about the ocean or their community in this way

previously, indicating the value in place based learning and understanding their place in turn helping students to respect their place.

Currently within the Irish secondary curriculum there is little focus on real life challenges such as climate change or environmental health and minimal exposure to the UN SDG's. In order for the Goals to work and be met we must all collaborate to build awareness, understanding and action and empower our next generation of leaders to do a better job on caring for our planet than we have.

In this research many of the Lessons we conducted did not have full attendance as students had other activities and classes scheduled which highlights the inconsistencies in TY that may occur in other schools also.

A SDG 14 module in the TY curriculum is a very good opportunity to bring in linked learning of real-world challenges opportunities, careers, innovation and wellbeing – dealing with stressful circumstances. Integration of more outdoor learning is also important as a number of studies have shown integration of outdoor learning aids in learning as it is thematic and interdisciplinary and important in sustainable development education.

Place based learning is important in connecting with real world authentic situations, the outdoor educational way of working means learning that is connected to authentic situations and learning environments. Building in elements of both green and blue space into the learning experience is a good idea to try to help ease eco-anxiety as we know from other studies that time in blue-green space can help anxiety. Having a SDG 14 module in secondary TY curriculum would be good for the Irish curriculum. Integration of more marine topics in secondary curriculum is also recommended which will increase ocean literacy and help align with objectives in Irish government report *Harnessing Our Ocean Wealth* Goal 3 'aims to increase our engagement with the sea'. Also increased ocean literacy through STEAM place based and inquiry-based learning can help students in critical thinking and make better informed decisions in their life which in turn could help environmental behaviour when it comes to climate action and environmental stewardship.

6. References

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