J-READING
JOURNAL OF RESEARCH AND DIDACTICS IN GEOGRAPHY
2, 13, December, 2024, pp. 151-166 DOI: 10.4458/7417-11

Place-Based Education for Ocean Literacy: Fostering Ocean Literacy and Place Attachment through short film

Silvia Stocco[a], Lorena Rocca[b]
[a] Department of Philosophy, Sociology, Education and Applied Psychology, University of Padua, Padua, Italy
[b] Department of Education and Learning, University of Applied Sciences and Arts of Southern Switzerland, Locarno, Switzerland and Department of Historical and Geographic Sciences and the Ancient World, University of Padua, Padua, Italy
Email: silvia.stocco.6@phd.unipd.it

Received: June 2024 – Accepted: November 2024

Abstract

This study explores the construction and transmission of marine images and imaginaries through a Place-Based Education (PBE) framework. It involves university students in the creation of short films focusing on their personal connections to the sea. The research explores the role of digital storytelling in shaping perceptions and fostering attachments to marine environments, using the 5E model for project design and evaluation. Data collection included pre- and post-project questionnaires, qualitative assessments of the short films, and reflections on the viewing experience. The findings highlight the transformative potential of visual storytelling in the creation of emotional and cultural connections with the sea. The study highlights the importance of using digital media to cultivate ocean literacy and citizenship, and emphasizes the power of imagery and imagination to enrich our relationship with the marine world. The report concludes by highlighting the importance of using digital media to promote marine education and civic engagement, emphasizing the power of images and imagination to enhance our relationship with the ocean.

Keywords: Place-Based Education, Imagination, Sea Imagery, Short Films, Ocean Literacy, Geography Teaching

1. Introduction

Sea covers two thirds of the surface of our planet. The lives of three billion people depend on its biodiversity and marine and coastal ecosystems. However, the health of the ocean is severely threatened by anthropogenic activities, leading to disruptions in marine ecosystems (Korpinen and Andersen, 2016; Lotze et al., 2018). Understanding the functioning of the ocean is key to addressing this ecological crisis (Ashley et al., 2019), and marine science education is a crucial tool in raising awareness and fostering sustainable behaviors (Dupont and Fauville, 2017). These complex interrelationships show the necessity of becoming "ocean literate" through appropriate individual and collective behaviors, but

achieving this through a behavioral change is considered difficult (Stoll-Kleemann, 2019). Recent studies show that K-12 students often demonstrate only moderate to low levels of ocean literacy (Mogias et al., 2019; Guest et al., 2015). The school curriculum in many countries remains terrestrially-biased, with ocean topics minimally integrated (Gough, 2017). Teachers play a crucial role in this endeavor, as they are key to incorporating ocean literacy into education (Mogias et al., 2015; Lin et al., 2020). However, several barriers prevent this integration, including limited environmental knowledge, a crowded curriculum, and insufficient educational resources (Eidietis and Jewkes, 2011; Boubonari et al., 2013; Fauville et al., 2018). This research aims to address this gap by exploring how Place-Based Education (PBE) and digital storytelling (DST) can foster ocean literacy among future teachers.

By involving university students in the creation of short films centered around their personal connections to the sea, this study investigates whether these methods can enhance emotional attachment to marine environments and promote a deeper understanding of ocean-related issues.

The project, titled "Place-Based Education for Ocean Literacy", was carried out during the 2021-2022 academic year with the aim of making students aware of how human health, safety and well-being are closely tied to the health and knowledge of the ocean. The challenge was taken up by L. Rocca (lecturer of Fundamentals and Didactics of Geography) and M. Piva (lecturer of Artistic and Media Education) of the University of Padova, in collaboration with a multidisciplinary group that involved the United Nations (UNESCO) and the team of Milano-Bicocca working on the GreenAtlas Project[1].

The project involved the group of fourth-year students enrolled in the Primary Education Sciences course at the University of Padova. As part of their coursework, the students were tasked with creating short films about the sea. This activity was aligned with the Ocean Decade (2021-2030), an international effort by the United Nations to raise awareness and promote practices for the ocean.

2. Theoretical background

The project was designed to be both an educational tool and a research approach. It aimed not only to integrate Geography and Media Education within university courses, but also to investigate whether the short film production and vision could foster a sense of attachment to marine environments and promote Ocean Literacy and citizenship among future teachers.

Ocean Literacy represents the capacity to understand and communicate the significance of the ocean for life on earth and humanity. Initiated through global educational efforts, Ocean Literacy is defined by seven fundamental principles encompassing essential knowledge of marine ecosystems, the interaction between ocean and climate, and the implications of the ocean for environmental and human health (Cava et al., 2005). These principles not only provide a conceptual foundation, but also serve as tools to foster environmental awareness and promote sustainable behaviors. Recent studies show that Ocean Literacy extends beyond merely conveying scientific knowledge; it engages emotional and social dimensions that are fundamental for motivating behavioral change (McKinley et al., 2020). This integrated approach highlights how Ocean Literacy is not only a cognitive skill but also a form of environmental citizenship involving values, attitudes, and a commitment to safeguarding marine ecosystems.

In terms of constructing imaginaries of the sea, a central focus of the study was to examine whether students could develop a personal sense of attachment to their "sea of the heart" – a deep emotional connection to the marine environment – through the process of designing and producing short films, as well as through viewing them. The pedagogical approach adopted for this project was rooted in Place-Based Education (PBE), an experiential methodology that emphasizes learning rooted in local environments and contexts (Gola and Rocca, 2021). This choice of methodology aligned with the project's aim to deepen

[1] The GreenAtlas project website https://greenatlas.cloud/#home-il-progetto.

participants' connection to the ocean through direct, reflective, and context-rich educational experiences. PBE encourages students to explore their immediate surroundings and engage with local cultural and environmental contexts, fostering a sense of responsibility and stewardship towards those environments. By incorporating PBE principles, the project intended to prompt students to anchor their narratives and reflections on marine environments to places of personal or collective significance. The hands-on nature of PBE complemented the objectives of Ocean Literacy, as students were able to relate marine conservation and environmental issues to their own "sea of the heart" ("marina del cuore") or local seascapes.

Studies on place attachment define it as the bonding between individuals and their meaningful places (Giuliani, 2003; Low and Altman, 1992). It is a symbolic relationship individuals form with places by attributing emotional meaning and shared understanding to them. This bond explains how people perceive and relate to places, reflecting the emotional and cognitive dimensions of their connection to a specific place (Altman and Low, 1992).

As a multidimensional concept, place attachment encompasses three key dimensions: the person, the psychological process and the place itself (Scannell and Gifford, 2010). The person dimension refers to who is attached, and whether the attachment is based on individual or shared meanings. The psychological process dimension involves the affective, cognitive, and behavioral responses individuals have towards a place. Those who feel a strong attachment often experience positive emotions like pride and love and may exhibit behaviors that seek to maintain a close connection with that place (Scannell and Gifford, 2010). Finally, the place dimension refers to various aspects of a place such as spatial scale, the level of specificity (from a single room to a broader landscape), and its social or physical characteristics. Even if a place is often conceived of as referring to a discrete, local, and contained area (Lyth et al., 2015), the attachment between an individual and a place can occur at different scales. It may be spatial scales, from the level of the house, neighborhood, or city, to the world (Lewicka 2011). Moreover, place attachment may occur at different time scales, to anchor past experiences and orient towards future goals.

A defining feature of place attachment is its focus on affect, emotion and feeling. Notably, it is not necessary to have a physical interaction with a place to develop a strong emotional attachment; in some cases, mental representation of places that one has never visited can evoke a deep sense of connection (Farnum, Hall and Kruger, 2005). Place attachment, with its deep emotional and cognitive dimensions, is closely tied to the human ability to imagine and conceptualize places, even those one may not have physically encountered.

Imagination plays a key role in this process, as it allows individuals to create mental representations and emotional connections with places through creative activity. Imagination is defined as the human ability underlying all creative activity and resulting from cognitive and emotional processes (Ho, Wang, and Cheng, 2013). It enhances the ability to form conceptual links with reality, stimulates creative invention and inspires social improvement based on life experience, thereby influencing our experience and thinking (Fleer, 2013).

In this context, digital storytelling becomes a powerful tool to engage students' imaginations and foster deeper connections to places like the ocean. By allowing students to creatively express their experiences and mental images through the medium of short films, digital storytelling offers an opportunity to reimagine their knowledge and enhance their learning process (Cheng and Chuang, 2018). Additionally, digital storytelling not only stimulates individual creativity, but also facilitates collaboration, opening up new pathways for students to engage with one another and explore shared connections to the places they depict (Ohler, 2008; Ranieri and Bruni, 2013).

3. Research structure

3.1. Participants and setting

The "Place-Based Education for Ocean Literacy" project involved a total of 176 fourth-year students enrolled in the *Scienze della Formazione Primaria* (Primary Education Sciences) course at the University of Padova. These students were attending two courses: Fundamentals and Didactics of Geography and Artistic and Media Education during their second semester of the academic year 2021-2022. As future teachers currently undergoing pre-service training, the participants ranged in age, starting from 22 years old, reflecting a diverse group of individuals preparing for careers in primary education.

The two courses mentioned above were conducted in integration, with both professors working closely to prepare students for the final project of producing short films designed as educational tools for pre-school and primary school children. The courses shared the common goals of involving students in both theoretical and practical activities that combined geographic knowledge with media education and examining how Place-Based Education (PBE) and digital storytelling could be used to foster ocean literacy and emotional attachment to marine environments.

To support students' collaboration, professors provided an online platform through Moodle, where students could access shared materials, tasks, and resources necessary for the film production. This integration of courses allowed students to benefit from a multidisciplinary framework, equipping them with both the content knowledge and practical skills needed to complete the project.

3.2. Project phases and methodology

Our research was guided by the hypothesis that visual tools and media, particularly short films, play a significant role in shaping and transmitting images of the sea, while also influencing the relationship between humans and marine environments. We aimed to explore both the creation process and the impact of viewing short films. On one hand, we sought to investigate whether the design and production of short films about the "beloved sea" would foster a sense of attachment in the students creating the films, linking the narrative to the place chosen. On the other hand, we hypothesized that short films could evoke a sense of place in the viewers of these short films, thereby fostering a deeper understanding of ocean literacy issues and promoting ocean citizenship (Voyer et al., 2015). In this context, the creation of sea imagery through DST was expected to evoke emotions, facilitating a connection to the places and forms of belonging that were narrated.

Following these hypotheses, the design of the project was structured using the 5E instructional model (Engage, Explore, Explain, Elaborate, Evaluate), which is widely recognized for promoting experiential learning and fostering deeper understanding through active engagement (Pompea and Russo, 2020). As previously considered in more detail (Rocca and Stocco, 2023), the 5E model was selected to guide the development of the project, from the initial engagement of the students to the final evaluation of their work. Each phase of the model was carefully adapted to align with the principles of PBE and the overarching goal of promoting ocean literacy and emotional connection to marine environments. Additionally, the backward design by competences (Castoldi, 2017) was adopted in the initial phase to ensure a clear alignment between the project objectives and student outcomes. A rubric for skills assessment was shared with the students at the outset, outlining the specific goals they needed to achieve by the end of the project.

Engage:

In this initial phase, students were introduced to the task of producing short films that could convey the values of the sea to children. The objective was to emotionally engage the students with their personal "beloved sea", as they reflected on their own experiences and bonds with marine environments. This phase also involved external professionals, enhancing the relevance of the project in both educational and territorial fields. For instance, Francesca Santoro from the OIC UNESCO participated by discussing the United Nations Ocean Literacy

Decade (2021–2030), providing students with a broader understanding of the global importance of ocean literacy. Additionally, professors from the Milano-Bicocca team, who were involved in the GreenAtlas Project, contributed to the initial engagement phase. These experts helped set the stage for students to begin reflecting on their personal experiences with the sea, preparing them for the production of digital narratives grounded in Place-Based Education (Gola and Rocca, 2021). The goal was to foster emotional and intellectual involvement with the concept of "ocean citizenship", where individuals recognize their responsibilities towards the ocean and its preservation.

Explore:

In the next phase, students participated in a sailing excursion to the Venice Lagoon, designed to promote a closer proximity to the marine environment and encourage a multi-sensory exploration. This hands-on activity was closely tied to the principles of Place-Based Education, allowing students to experience the sea through direct sensory engagement. The students collected footage during this excursion for use in their short film productions, ensuring their creative projects were grounded in their personal, sensory experiences with the sea.

Explain:

During the courses, triangulation meetings were held between peers and experts, including the actors mentioned earlier, to deepen students' understanding of geographical knowledge in relation to media. Students utilized the Padlet collaborative board to identify their own "sea of the heart", reflecting on personal experiences and attachment. The Miro collaboration board served as a repository for gathering sources on the theme of the sea from various perspectives, combining geographical and media-related insights (movies, books, poems, pictures, …). Additionally, students were tasked with analyzing short films from the GreenAtlas project, using the same rubric they would later apply to assess their own video productions. The analysis was essential for understanding how geographical concepts and place-bonding can be effectively communicated through short films and how these elements could be integrated into a media production.

Elaborate:

In this phase, the students worked in groups to produce their short films applying both the technical skills and geographical knowledge they had acquired during the courses. Each group was supported throughout the process by tutors who provided guidance and feedback. Each student's group focused on the "sea of the heart" they had chosen earlier and developed a narrative centered around that specific place. It was essential for them to keep in mind that their short films were intended for pre-school and primary school children. Therefore, they had to craft their stories in a way that would be engaging, educational, and accessible to young audiences.

Evaluate:

At the end of the project, each group of students uploaded their produced short films to the Moodle platform. The evaluation phase was conducted through Moodle using the tool "Feedback Fruits" which facilitated a comprehensive assessment process involving self-assessment, peer evaluation, and experts evaluation. The evaluation was structured around an assessment grid, requiring both quantitative and qualitative feedback. In line with the trifocal perspective evaluation (Castoldi, 2009), every student took on the role of a reviewer, providing feedback on the short films produced by their peers. This peer review process was complemented by self-assessment, where students evaluated their own work and reflected on their learning experience. Additionally, professors assessed the short films, providing expert feedback to ensure that both technical and educational goals were met. This multi-layered evaluation approach allowed for a well-rounded assessment of each group's project, encouraging critical reflection and collaboration while maintaining alignment with the project's overall objectives. In total, 37 short films were produced and evaluated. The short films were designed for children and focused on themes related to Italian seas. They were produced employing a variety of production techniques, including motion capture, live action, found footage, old and new photographs, stop motion

animation, and GIFs. A selection of these short films is now accessible for the scientific community having been included in the GreenAtlas[2] as part of the Project of Relevant National Interest (PRIN) "Greening the Visual: an Environmental Atlas of Italian Landscapes" coordinated by Prof. Elena Dell'Agnese and for the GREAM[3] group of Milan Bicocca by Prof. Squarcina and Dr. Neri.

4. Data Collection and Analysis

Data collection for this project was conducted through a combination of pre- and post-project questionnaires, qualitative assessments, and structured evaluations of the produced short films. The instruments used included questionnaires for measuring place attachment and ocean literacy dimensions, as well as peer, self, and expert evaluations for assessing the short films. Both quantitative and qualitative data were collected to assess the educational outcomes and the emotional connection to the sea fostered by the digital storytelling process.

4.1. Exploring Place Attachment and Ocean Literacy: Questionnaire Design, Implementation, and Results

Pre- and post-project questionnaires were administered to evaluate students' sense of attachment to the sea before and after the making of the short film. The questionnaire items were based on the three-pole and four-dimensional model of place attachment proposed by Raymond, Brown, and Weber (2010), measuring dimensions such as place identity, place dependence, social bonding, and nature bonding. The items of the questionnaire section related to these dimensions are displayed in the column on the left side of Figure 1.

As can be seen in the comparison in Table 1, this model is similar to the tripartite model of place attachment presented by Scannel and Gifford (2010) but there are some differences regarding the social and environmental attributes of the place, the characteristics of the person, how affect, cognition, and behavior are manifested, and the scale to which the model refers (Raymond et. al. 2010). The three poles include personal, community and environment while the four proposed dimensions of place attachment are place identity, place dependence, social bonding and nature bonding. Despite the differences, both models recognize that place attachment is related to social and environmental attributes of a place (Raymond et. Al. 2010).

Place attachment models	**Poles**	**Dimensions**
Three-pole and four-/dimensional conceptual model (Raymond et. Al. 2010)	Personal	Place identity
		Place dependence
	Community	Social bonding
	Environment	Nature bonding
The tripartite model (Scannel and Gifford, 2010)		Person: cultural group/individual
		Psychological Process: affect, cognition, behavior
		Place dimension: social, physical.

Table 1. Comparison of place attachment models. Authors' elaboration.

Additionally, this questionnaire was designed considering the Ocean Literacy (OL) dimensions, in line with contemporary understandings of ocean literacy as being not only knowledge-based but also encompassing emotional connections, attitudes, and behaviors (McKinley et al., 2020). The six dimensions of Ocean Literacy – awareness, knowledge, attitude, communication, behavior, and activism – were reflected in different items of the questionnaire. For example, awareness – which involves basic knowledge and understanding of the significance of the ocean – was evaluated through items such as "The relationships developed by doing various sea-related activities

[2] The Green Atlas section referring to "Place-Based Education for Ocean Literacy" project. https://greenatlas.cloud/ricerca-tematica/?_search=Universit%C3%A0%20di%20Padova&tx_category=paesaggi-marini&tx_tipologia_materiale=audiovisivo.
[3] The GREAM website https://gream.it/.

connect me more closely to this environment", "Doing my activities by the sea is more important to me than doing them elsewhere", and "I learn a lot about myself when I spend my time by the sea". These items focused on how participants become more mindful of the relationship between themselves and the sea. The knowledge dimension, which directly measures what participants know or come to realize through their experiences, was assessed specifically through the item "I learn a lot about myself when I spend my time by the sea". This reflects not only self-awareness but also the knowledge gained from engaging with the marine environment.

The attitude dimension – critical for capturing participants' emotional connections and values related to the sea – was reflected in several items, such as "The sea is the best place to do the activities that I love to do", "When I spend my time at the sea, I feel a deep sense of union with nature", and "I strongly identify with the sea". These items encapsulate the participants' emotional attachment and sense of identity tied to the ocean, demonstrating the emotional depth of their connection to the marine world. Although communication was not explicitly measured in this questionnaire, other dimensions were thoroughly addressed. The behavior dimension, which concerns how participants' choices and actions are influenced by their connection to the sea, was captured through items such as "Doing my activities by the sea is more important to me than doing them elsewhere" and "I go to maritime environments". These items reflect the tangible actions and decisions participants make regarding their engagement with marine environments.

Lastly, activism – which reflects active participation in marine conservation or related collective actions – was directly addressed through the item "Belonging to a group of volunteers working at and/or for the sea is very important to me". This item measured the participants' proactive involvement in actions supporting marine preservation and their willingness to engage with environmental efforts.

During the initial phase of the project (Engage) and again at the end, students were asked to rate their level of agreement with various statements on a four-point Likert scale, ranging from 1 (strongly disagree) to 4 (strongly agree). The average score for each item was calculated across all participants. In total, 67 students completed the initial survey, while 33 participated in the final survey. Of these, 19 students completed the questionnaire both before and after the project, allowing for direct comparison of their responses. Analysis of the data revealed that the post-project scores were generally consistent with those from the pre-project survey, showing only slight variations between the two sets of responses.

Although there were no statistically significant differences between the pre- and post-test results (as shown in Figure 1), the data did reveal some trends that indicated a stronger sense of social bonding and emotional attachment to the sea. Several students reported that the relationships formed through ocean-related activities, in this case the making of short films as a group, further strengthened their connection to the place. This outcome may be linked to the social bonding dimension, as working in groups likely fostered a sense of shared experience. Furthermore, the increased connection to the sea could also be related to the awareness dimension of Ocean Literacy, as the students became more mindful of their relationship to the ocean during the project.

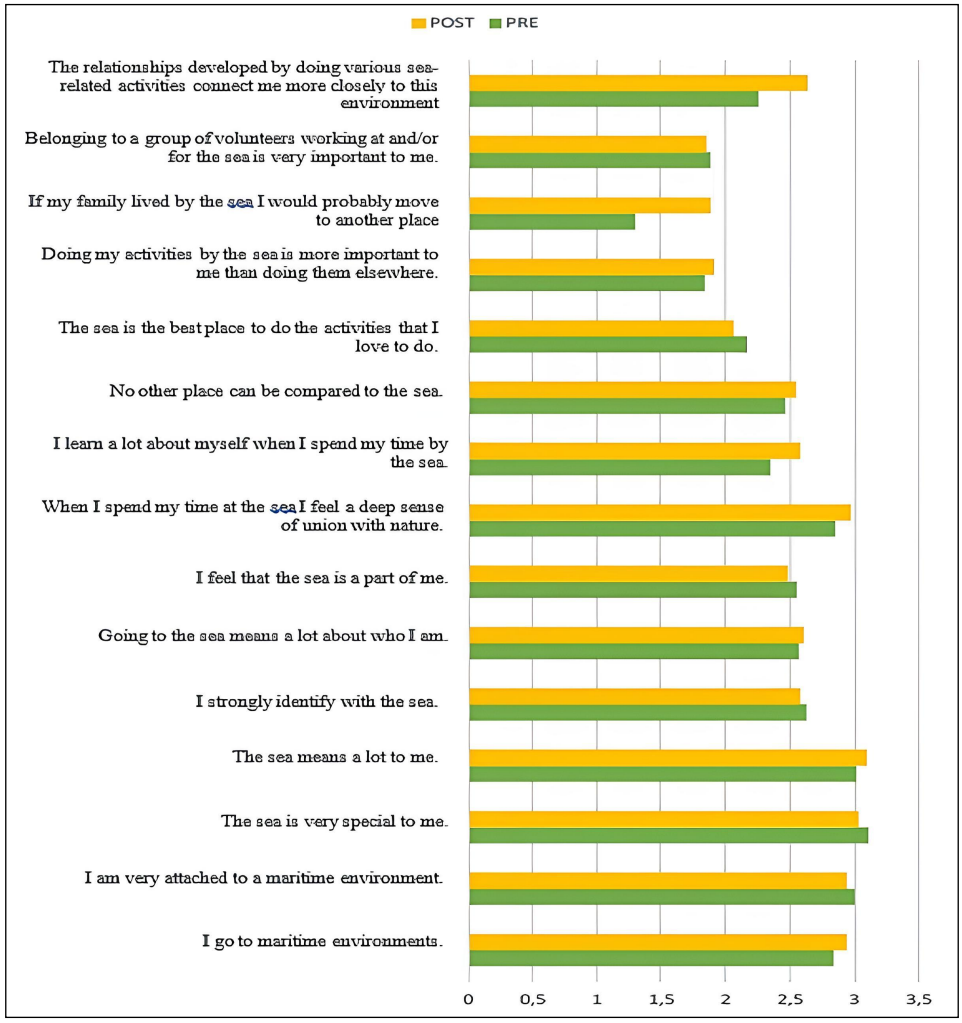

Figure 1. Average of the scores for each item of the place attachment measure as reported by students. Authors' elaboration.

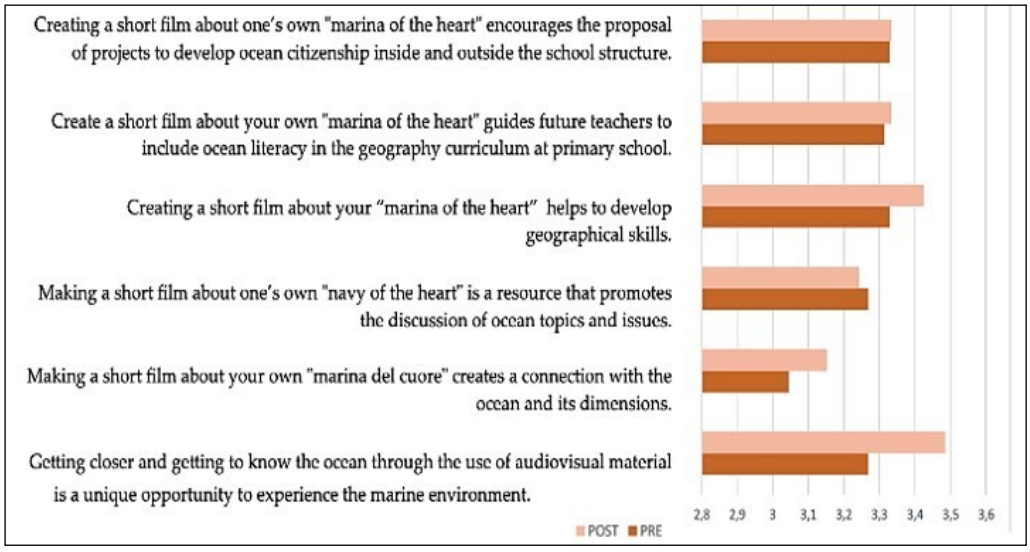

Figure 2. Average values of the responses to the questions in the "short film and Ocean Literacy" section of the questionnaire. Authors' elaboration.

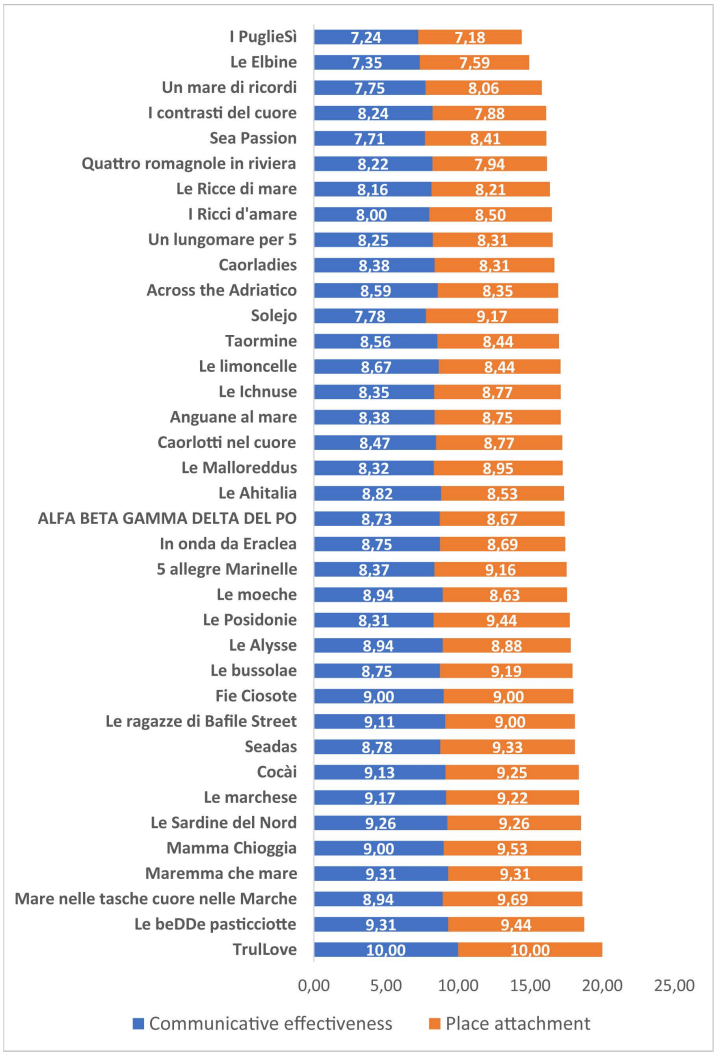

Figure 3. List of groups based on the sum of the average scores obtained from peer evaluations regarding the dimensions of "communicative effectiveness" and "sense of attachment to the sea". Authors' elaboration.

In particular, the statements "I learn a lot about myself when I spend time at the ocean" and "When I spend time at the ocean, I feel a deep sense of union with nature" received higher scores in the post-test phase. These findings suggest a shift in participants' emotional and reflective engagement with the sea, even though the overall statistical differences between the pre- and post-tests were minimal. This increase in emotional connection points to a deeper personal reflection and attachment fostered through the course, indicating that while knowledge and behavior might not have changed drastically, the project succeeded in nurturing a stronger emotional bond with the marine environment.

The second part of the questionnaire (the items are displayed in the left side of Figure 2) explored the relationship between short film making and approaching ocean literacy issues, with the hypothesis that the creation of mental images resulting from the short film making process could increase awareness of ocean literacy issues and their importance in formal and non-formal education, particularly among future teachers.

As illustrated in Figure 2, on average, the post-project responses showed slight but consistent increases across most items. Although the quantitative progression was modest, these shifts underscore the impact of the project on students' understanding of how audiovisual materials can be integrated in both formal and

non-formal education to teach ocean-related concepts. Notably, there was a clear positive shift in how students perceived the creation of short films about their own "sea of the heart" ("marina del cuore") as a tool for developing geographical skills and addressing ocean literacy issues in the primary school geography curriculum. Additionally, responses to the statement "Getting closer and getting to know the ocean through the use of audiovisual material is a unique opportunity to experience the marine environment" showed an increase. These results may suggest that the audiovisual medium facilitated a stronger experiential connection with the sea, reinforcing the idea that Place-Based Education and digital storytelling are powerful methods for fostering emotional attachment and awareness of the marine environment.

An interesting trend emerged in the analysis of the questionnaire responses, specifically regarding the statement "Making a short film about one's own 'navy of the hear' is a resource that promotes the discussion of ocean topics and issues". As shown in Figure 2, there was a decrease in the average score for this item from the pre-test to the post-test phase. Initially, students seemed to hold higher expectations of the potential for digital storytelling to act as a resource for facilitating discussions on ocean-related topics. However, by the end of the project, the post-test results suggest that students re-evaluated the effectiveness of their short films in promoting such discussions. This decline can be interpreted in several ways. First, it is possible that, while the short films were effective in fostering a personal connection to the sea, they did not fully meet the students' expectations for stimulating critical discussions about broader ocean literacy issues, such as environmental sustainability, conservation, and the impact of human activities on marine ecosystems. The storytelling process may have prioritized emotional and imaginative engagement over the inclusion of detailed, complex discussions on ocean-related issues, resulting in a discrepancy between initial expectations and post-project evaluations. While the project effectively encouraged personal and emotional connections to marine environments, it may have lacked the depth needed to address more complex and systemic oceanic topics. The decrease in the score could reflect the students' recognition of this gap, as they realized that personal narratives, though powerful, may not always translate directly into educational tools that facilitate comprehensive discussions on marine conservation and ocean governance.

4.2. Impact of Viewing Ocean-related Short films on Place Attachment and Sense of Place: Peer and Expert Evaluations

The second focal aspect of this study was to examine the effect of viewing the short films and how they influenced the viewers. It was hypothesized that digital storytelling could promote a sense of place and attachment, as place attachment is a fluid concept that can change over time and is socially constructed, with attachments to both "imagined" and real places (O'Neill and Graham, 2016). The relationship between geographical and imaginative elements shapes one's sense of place, and highlights the significance of imaginative links we have with each other and with our surrounding communities (Kearns et. al., 2015).

To investigate this concept, in the last phase of the project (Evaluation), the student groups shared their short films on Moodle and each short film was evaluated from a trifocal perspective (Castoldi, 2009) using the Feedback Fruits tool. The evaluation process involved peer assessments, self-assessments, and expert evaluations. A total of 528 peer evaluations, 176 self-evaluations, and 74 expert evaluations (conducted by the two professors, who provided ratings and comments for each film) were collected. The Feedback Fruits tool on Moodle was configured so that each student conducted a self-evaluation of their own short film using a rubric. Additionally, each student involved in the project evaluated three other short films, applying the same rubric used for their self-assessment. The professors assessed all 37 short films produced by the groups.

Quantitative and qualitative [4] data were collected to evaluate both the communicative

[4] All qualitative data collected can be accessed here https://docs.google.com/spreadsheets/d/1Ru_ucOkrD

effectiveness of the short films and their ability to promote a sense of attachment to the sea. The evaluations were rich in descriptive feedback, with participants providing both structured ratings and open-ended comments. The rubric employed for the evaluations consisted of five dimensions, three of which were related to the technical aspects of audiovisual production (title, technical quality, script), while two were focused on geographical content (communicative effectiveness and sense of attachment to the sea). Specifically, the dimensions were as follows:

- Short film title: Please rate the short film title on a scale of 1 to 10. Does it make you want to continue watching? Is it concise, catchy and evocative?
- Technical rating: Please rate the technical aspects of the work on a scale of 1 to 10., specifically evaluating the effectiveness of editing techniques, music, sound effects and photography.
- Script: Please rate the script on a scale of 1 to 10. Think about the idea, the themes, the characters and the use of maritime elements in the setting.
- Communicative effectiveness: please rate the communicative effectiveness of the geographical aspects on a scale of 1 to 10. Does the short film present the complexity of the geographical issue? Is the sense of place well represented? Does it have an impact on the imagination (topophilia, topophobia)?
- Sense of attachment to the sea: Please rate the ability of the short film to create a sense of attachment to the place on a scale of 1 to 10. In particular, does the film make you want to go to the place in question? Does it capture your attention and create an emotional connection?

This structured evaluation framework allowed for a comprehensive assessment of both the technical and emotional elements of the short films, aligning with the objectives of the project to explore the use of digital storytelling as a tool for enhancing geographical understanding and fostering emotional connections to the sea. Figure 3 presents the average scores assigned by the evaluators to each of the 37 short films produced, based on two key dimensions: “Communicative Effectiveness” and “Place Attachment”. The group names are displayed on the left side of the figure. The chart illustrates that while some short films performed strongly in terms of fostering place attachment, others excelled in communicative effectiveness, with some achieving high scores in both categories.

Regarding the qualitative comment of the reviewers, we applied a thematic analysis (Braun and Clarke, 2006) to explore how participants engaged with the viewings of the short films, particularly focusing on their emotional attachment to the sea and the effectiveness of audiovisual materials in fostering a sense of place. The aim of the thematic analysis was to identify recurring patterns, themes, and insights that emerged from the qualitative data collected during the evaluation phase.

The qualitative data consisted of 712 comments on communicative effectiveness and 695 comments on sense of attachment to the sea, collected using the Feedback Fruits tool. We conducted the thematic analysis using a deductive approach based on predetermined themes related to ocean literacy and place attachment. Additionally, we allowed inductive themes to emerge organically from the data. The first step involved reading through all the comments multiple times to gain an initial understanding of the data. After familiarization, the data were coded systematically, assigning labels to meaningful excerpts that reflected core concepts. The initial codes were grouped into broader themes. For example, codes related to emotional connections and reflections on the sea were categorized under *Sense of Place Attachment*, while comments on the technical aspects of the films were grouped under *Audiovisual Impact*. Next, the themes were reviewed to ensure they accurately represented the data by comparing them with the original data set for consistency. Finally, each theme was defined and named in alignment with the research objectives. The key themes identified were *Sense of Place Attachment*, *Audiovisual Impact*, *Topophilia/Topophobia*, *Environmental Awareness*, and *Social and Cultural Reflection*. In the following section, we will present each of the key themes identified during the thematic analysis, providing illustrative comments from the peer reviewers. While we do not claim to offer an exhaustive report of all the feedback received, our aim is to highlight the most

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prominent themes that emerged throughout the evaluation process. These selected comments will help to demonstrate the variety of perspectives and insights offered by the reviewers, reflecting the central ideas and emotional connections developed in the short films.

Sense of Place and attachment

A dominant theme in the evaluations was the emotional connection participants felt towards the places depicted in the short films. Many evaluators emphasized how the films fostered a sense of belonging and personal connection to the marine environments. For instance, one peer reviewer commented:

"Many elements are presented in the short film, some new and never considered, such as boats, fishermen and *casoni* [5] . This reveals deep knowledge of the place and attachment that has been built up over time and I think it began long before the video was shot. It is precisely these hidden elements behind the beaches and the sea that inspire the viewer's imagination to discover them, to go beyond the sea and get to know the inhabitants and their way of life".

"Also referring to my previous comment: I think this short film develops a sense of place in two ways:

- Through the beauty of the environments shown and their emotional connection to each viewer's marine experience;
- Through the sense of protection that can be evoked by the sight of the impact that the presence of litter has on such a place.

The short film captures the viewer's attention and you can feel the emotional connection that the authors wanted to convey".

"It makes me want to discover more of the place. It attracts my attention. On the emotional level I felt immersed in the history of the place so I would say that it allows you to grasp the emotional connection with the place".

The short film captures the viewer's attention and you can feel the emotional connection that the authors wanted to convey".

"It makes me want to discover more of the place. It attracts my attention. On the emotional level I felt immersed in the history of the place so I would say that it allows you to grasp the emotional connection with the place".

Audiovisual Impact

The technical aspects of the short films were also frequently highlighted in the evaluations. Participants often referred to the use of sound, visuals, and editing as crucial in making the geographic and emotional content of the films more engaging.

"The geographical aspects are well represented by the images. Although they have been created using the 'painting' technique, they are faithful to the reality of the place. The choice of a painted image, rather than a photograph, helps to arouse the curiosity of the public".

"Regarding the sense of place and the character's emotions I think they are clear both in the video and in the inserted audio. Definitely there's a positive affective dimension and we can understand it through the audio and images".

Topophilia vs Topophobia

Another key theme that emerged was the emotional response to the places depicted in the short films, with a clear distinction between positive (topophilia) and negative (topophobia) reactions.

"For sure, this short film really touches the imagination and I find that it brings the adventure to life with serenity and joy, so there is no aspect of topophobia present, on the contrary I find more aspects of topophilia there. In the short film, I noticed that real and concrete aspects are identified and presented, as well as the characteristics of spaces and objects(...)".

"Topophobia is well-represented in the plastic fish and in the first part of the video, which is in black and white... it conveys a sense of anguish (...)".

Environmental Awareness

Several evaluators also reflected on the environmental themes presented in the films,

[5] "Casoni" refers to large wooden houses typically found in coastal or lagoon areas.

particularly concerning conservation and the human impact on marine environments.

“The short film seems to express the need to protect the sea and its characters from pollution, although it presents this issue from the animals' perspective, who appear to have to recognize the dangers, rather than focusing on humans, who should primarily avoid creating these dangers”.

“By including the pollution issue you have given extra value to the video”.

“It does not ‘only’ arouse the desire to go and visit this area, but prompts one to fully understand the ‘meaning of life’ of the inhabitants, while also actively setting out to solve its problems”.

Social and Cultural Reflection

The use of personal stories, legends, and cultural elements in the short films was another prominent theme. Many evaluators appreciated the blend of natural and cultural aspects, as demonstrated by the following comment:

“This short film has a good communicative effectiveness which tries to understand all the elements related to the sense of place and the history of the sea while keeping in mind its cultural characteristics. It stirs the imagination especially when it invites us to close our eyes and listen, to imagine, ... The aim is to develop a sense of attachment to the place and to convey the emotions and feelings that the authors of the short film feel when they think about the ‘sea in their hearts’”.

“Right from the start, you can feel the emotional connection with the sea of the Marches. Thanks to the story it tells, it manages to capture the attention of the viewer and arouse a certain curiosity to visit these places in person”.

“In my opinion, the short film evokes a sense of topophilia, thanks to the presence of the ‘book of legends’, which serves as the thread that supports the entire narrative. The presence of witnesses allows for a greater sense of involvement and a more authentic representation of the city of Chioggia”.

“The video is aimed at children (a family experience) who will be fascinated by the story told and want to go on an adventure like Davide! Watching the video again, you will notice that the typical Venetian places (St Mark’s, Rialto, Accademia, Arsenale...) are completely absent, underlining the choice to show the intimate places of Venice”.

5. Conclusions

This study set out to explore the potential of Place-Based Education and short films as tools to foster ocean literacy and deepen emotional connections to the marine environment, specifically among university students of Primary Education. Recognizing the urgent need for ocean literacy to address global marine issues, the project aimed to connect future teachers with the ocean on a personal and educational level. The approach is grounded in the understanding that fostering a meaningful attachment to marine environments can inspire sustainable behaviors and empower teachers to integrate ocean-related issues in the primary education geography curriculum. Through the production of short films on their “sea of the heart” designed for preschool and primary school children, participants not only engaged deeply with ocean concepts but also reflected on the broader role of the ocean in human life. This place-based approach thus offers a valuable alternative to conventional, knowledge-centered methods, underscoring the importance of emotional and imaginative engagement in geography education. The short films produced by the students demonstrated the ability to communicate complex information in an engaging and accessible way. It highlighted that effective integration of technology requires that teachers integrate technology into authentic tasks which help students construct their learning from their thinking and life experiences (Sadik, 2008; Trilling and Hood, 1999).

The findings suggest that integrating Place-Based Education with Digital Storytelling can impact future teachers’ emotional connection to marine environments, enhancing their awareness and sense of place toward the ocean. This, in turn, is likely to be reflected in their future teaching practices, fostering similar connections and environmental awareness in their own students.

Through the pre- and post-project questionnaires, we observed that while statistical differences were minimal, there was a qualitative shift in students' emotional attachment and reflective engagement with the ocean, with increases in items related to self-discovery and unity with nature. Additionally, the process of creating and viewing short films emerged as a powerful tool for fostering a sense of place attachment and environmental awareness. Considering the process of creation, the short films were an opportunity for the students to express their individuality and to express their feelings about the sea. Through the filmmaking process, students develop a deeper understanding and appreciation of the marine environment. This experiential learning, combined with a positive and supportive approach, fosters a sense of ownership and responsibility towards the ocean. As far as the enjoyment of the videos is concerned, the sharing of the short films allowed the students to make their "sea of the heart" known to others by sharing their images.

The thematic analysis of peer evaluations further revealed that the short films fostered place attachment, with comments highlighting themes of *topophilia* and *topophobia*. Feedback from reviewers also emphasized the audiovisual impact, underscoring how sound, visuals, and narrative contributed to a strong sense of place and a desire to protect marine spaces. However, some students expressed concerns about the films' potential to fully stimulate critical discussions on broader ocean literacy issues, suggesting to the researchers an area for further refinement in addressing complex topics within those frameworks.

Considering the project critically, this study had a number of limitations that future research could address to enhance the strength and applicability of the findings. One limitation refers to the sample composition. The study focused on preservice teachers within a specific university setting, which may limit the generalizability of the findings to broader educational contexts or diverse student demographics. Future research should explore the impact of PBE and DST on various age groups, as well as students from different backgrounds and geographic regions.

Another limitation involves the reliance on self-reported data through pre- and post-project questionnaires, which could introduce response biases, especially given the lack of significant statistical differences in some areas. Additionally, the short project timeline may not have been sufficient to foster deep, lasting emotional connections to the marine environment, as evidenced by modest quantitative shifts. Longitudinal mixed methods studies could provide more insight into the durability of place attachment fostered, revealing whether these connections and attitudes persist beyond the initial period. Future work should also explore ways to address broader ocean literacy topics, balancing emotional engagement with critical discussion of ocean conservation issues.

The use of emerging technologies, such as virtual reality (VR) and augmented reality (AR), in environmental education offers another promising avenue for exploration. These tools could further enhance students' engagement by providing immersive experiences that bring the marine world to life, potentially strengthening place attachment and emotional connection.

Finally, this research opens avenues for developing new frameworks in geographical digital storytelling, particularly as they apply to cultivating place-based connections and environmental awareness. A future focus on pedagogical innovation informed by these experiential and research-backed strategies promises to advance not only ocean literacy but also broader environmental education goals. These methods could contribute significantly to our understanding of how experiential and place-based practices can protect and sustain our planet, providing educators with new tools to foster ecological consciousness and sustainable behaviors across diverse learning environments.

Overall, the project highlights the potential of marine imagery, conveyed through short films, to bridge the gap between people and the ocean, fostering not only knowledge, but also an emotional connection and a sense of responsibility for our blue planet.

Acknowledgements

S. Stocco, as the principal author, was responsible for drafting paragraphs 3 and 4 and managing the final writing, review, and editing of the manuscript. L. Rocca, as co-author, designed and initiated the experimental framework with the student group, contributing significantly to paragraph 1. The collaborative efforts of both authors led to the development of paragraphs 2 and 5.

The Authors would also thank Camilla Meneghin who participated in the project and contributed to the data collection for her Master's thesis in Primary Education at the University of Padova during the academic year 2021-2022. Part of this paper is based on her findings.

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