Float Forward: Translating Marine Science into Stories

Shimeng (Jasmine) Zhu, Middlebury Institute of International Studies at Monterey

Mentor: Dr. George Matsumoto

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ABSTRACT

This paper highlights the use of StoryMap, developed by Esri to attract more attention for the Adopt-A-Float program, thus exposing a larger audience to ocean education. During a ten-week summer internship, four StoryMaps were made, targeted at different age groups. By testing it out at the MBARI EARTH workshop in Oregon, StoryMap was proven to be a useful tool for both in-class and self-exploration. The interactive functions of the StoryMap ensured that the marine knowledge involved was entertaining. The paper also explores the potential for classroom use and public outreach of scientific research.

1. INTRODUCTION

1.1 PROJECT INTRODUCTION

The Monterey Bay Aquarium Research Institute (MBARI) has long been committed to marine science and engineering, advancing technologies to facilitate ocean exploration. As climate change accelerates, it is urgent for the world to study how the ocean is changing and how those changes affect us. This task will require a large amount of data to support, yet manually collecting data across the world would be costly and impractical. Therefore, Argo floats is a great way to take over the impossible task from human beings, ensuring continuous data collection even in remote and challenging environments such as the polar regions. It is equally important to ensure the data is used, not only by researchers and scientists, but also by the general public. MBARI's Adopt-A-Float program connects students and educators with real-world science, brings marine knowledge into classrooms, and inspires the next generation.

1.2 GO-BGC: THE GLOBAL OCEAN BIOGEOCHEMISTRY ARRAY

The Global Ocean Biogeochemistry Array (GO-BGC) is supported by the National Science Foundation, aiming to deploy 500 floats over a time period from 2021 to 2026. GO-BGC uses autonomous robotic floats to measure key parameters like dissolved oxygen, nitrate, pH, and chlorophyll (GO-BGC, 2025). All the data are freely available within 24 hours of transmission. Continuous data collection plays a critical role in monitoring ocean health, as well as improving climate models (Matsumoto et al., 2024).

Partnerships of the GO-BGC program include the Monterey Bay Aquarium Research Institute, the University of Washington, Scripps Institution of Oceanography, Woods Hole Oceanographic Institution, and Princeton University.

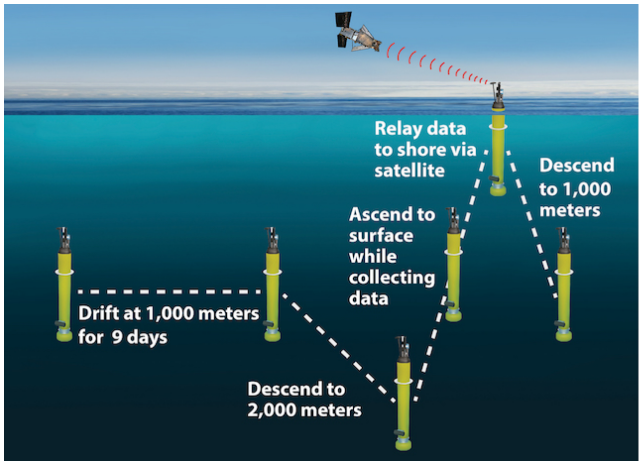

Figure 1: A BGC-Argo float collects data between the surface and 2,000 meters deep over 10 days. Image: Kim Fulton-Bennett © 2020 MBARI

1.3 THE ADOPT-A-FLOAT PROGRAM

The Adopt-A-Float program is the outreach effort of the GO-BGC project. This program was created to link education with real-time ocean profiling data and scientists. Educators and students can name the float that is set for deployment free of charge. Relevant information can be found on the GO-BGC website, including float tracks and real-time data sent back by the float.

MBARI makes efforts to expand the influence of this program other than adopting the floats. It has a data visualization website, AdoptAFloatViz, where users can manipulate variables and build their own plots based on the parameters they choose. MBARI has developed a separate website for educators, a simplified version of the AdoptAFloatViz, with only important parameters listed and attached with PDF files as explanations, to make data more accessible. In addition, MBARI hosts an Education and Research: Testing and Hypotheses (EARTH) Workshop, which invites teachers from all over the country to attend. Teachers are encouraged to adopt floats and develop lesson plans about the float.

There were over 90 floats adopted by the summer of 2022 (Phillips, 2022). In comparison, 243 GO-BGC floats and 241 SOCCOM floats are adopted.

1.4 STORYMAP

StoryMap is a web-based tool developed by Esri. It supports a wide range of media, like texts, videos, audios, images, maps, etc., elements that are essential to digital storytelling. Many government agencies and nonprofit organizations use StoryMaps as a way of science communication, such as the National Oceanic and Atmospheric Administration and the Nature Conservancy. As a form of digital storytelling, StoryMap can facilitate both science communication and education.

Effective science communication should not only provide people with information but also make them care, which means more than just presenting facts and evidence (Joubert et al., 2019). Storytelling combined with data and scientific facts can achieve a balance between the two, helping to establish emotional connections between scientists and the general public.

One advantage of StoryMap is that it provides diverse functions to make the content interactive, thus sparking students' curiosity and retaining their attention. Integrating visual materials with written text has been shown to both enhance and accelerate students' comprehension of a topic (Alismail, 2015), making StoryMap a valuable tool in this case.

The common steps of creating a digital story include planning, writing a script, preparing a storyboard, collecting necessary materials, production, and evaluation (Çetin, 2021). Considering the features of StoryMap and the evolving definition of digital stories with technological advancement, this paper omits the preparation of storyboards.

2. MATERIALS AND METHODS

2.1 PLANNING

The planning stage involves determining the target audience and developing scripts accordingly. Target audiences were selected based on educational levels: primary school, middle school, high school and college. The content for each StoryMap was mostly designed for the target age group based on their learning abilities and needs.

2.2 STORY WRITING & STORYMAP BUILDING

Primary School: For this age group, the language should be simple and accessible, while maintaining a playful tone. Therefore, the story was narrated from the perspective of a float and relied on images and videos to retain students' attention. The StoryMap humanized the float as a "doctor of the ocean" and then explained the functions of each part with the support of images. The second part simulated the float's descent into the ocean, introducing marine animals at different depths and concepts of ocean zones. Videos were added to the background to match the text. The third part inserted a clickable time-lapse map to show the track of a demo float. Finally, instead of directly asking students to "adopt a float", the final part invited them to "join the float to be an ocean doctor", thus encouraging participation.

Middle School: This age group may have some exposure to science. Therefore, this StoryMap was themed around hurricanes, starting with the formation of a hurricane, accompanied by background audio to create an immersive experience. An illustration was designed to show the differences between hurricanes, typhoons, thunderstorms, tornadoes and hail in terms of where and when they might occur. Because hurricanes and typhoons are all evolved from storms, a map was used to present the regions of the world where typhoons or hurricanes occur. This part also included an animation produced by NOAA to explain how hurricanes form, with short quizzes on the side to help students follow every step of the process. The second part moved on to the impacts of hurricanes, using maps and graphs to show casualties and damages caused by major hurricanes in the past 20 years. With all those numbers and the seemingly more frequent hurricanes, students may conclude that storms and hurricanes are more frequent. Therefore, the third section began with a provocative question "are there more storms than before" to challenge their assumption. Here, graphs were paired with guiding texts to lead students through data interpretation and encourage them to draw their own conclusions. By the end of this section, they would recognize that there is no clear evidence showing that warming oceans lead to more storms. Building on this, the fourth part explained why people are feeling that storms are occurring more frequently and why scientists cannot prove that yet. One of the reasons is the lack of long-term and continuous data. The StoryMap ended with an invitation for students to join and adopt the float, filling in the blank and helping scientists solve the mystery.

High School: One feature of this age group is that students are facing one of their life decisions: choosing a major for college. However, not every student has the chance to know what different majors look like in real life, and some may struggle to balance their personal interests with career pathways. This StoryMap aims to show the majors and jobs related to building and operating a float. By highlighting majors such as electrical engineering, computer science, oceanography and science communication, this StoryMap can show how different choices can come to the same goal of ocean conservation. In doing so, the StoryMap will help students to see that diverse academic paths can all contribute to solving environmental challenges.

College: According to the definition of the Oxford Dictionary (Oxford, 2025**),** data refers to facts or information, especially when examined and used to find out things or to make decisions. This definition indicates that data interpretation is as important as data collection. In the 2023 Adopt-A-Float program survey, one of the biggest obstacles teachers faced in using float data was time, including both preparation and planning time (Corbin, 2023). Though college students have more time than educators as they do not need to transform what they learned into a class curriculum, the effort needed to research and understand parameters can dampen their enthusiasm to use the data. Therefore, this StoryMap selected parameters from the MBARI Adopt A Float dataset (Adopt A Float Data, 2025), which is designed for educators and provides a less sophisticated interface. All parameters were explained with typical profiles included. The ultimate goal is not only to familiarize students with using float data but also to guide them in exploring the meaning behind the data, such as data points different from typical profiles and the reasons behind them. By cultivating students' abilities to read and interpret data independently, the StoryMap aimed to engage them as active participants in science, thus contributing to monitoring float performance and reporting anomalies to researchers in time.

2.3 Evaluation

Not all StoryMaps were evaluated. Since they were designed for self-learning purposes, it was hard to gather feedback from the target audience. However, a survey was included at the end of each StoryMap for further improvement. At the time of this paper's submission, the StoryMap for high school students is still developing.

3. RESULTS

EARTH WORKSHOP

Education and Research: Testing Hypotheses (EARTH) Workshop is hosted annually by MBARI and brings teachers from all over the country. Educators work directly with scientists and engineers to integrate their data sets into the lessons they develop. During this five-day workshop, educators participate in scientific activities and attend presentations from invited speakers for inspiration. On the second-to-last day, they need to develop a complete lesson plan individually or collaboratively and present on the last day. The 2025 EARTH Workshop was held in Newport, Oregon, with 17 educators participating.

By the time of the workshop, two StoryMaps had been completed (primary school and middle school) and posted on the EARTH website. Both StoryMaps, along with a tutorial on how to use the StoryMap as a tool, were presented at the workshop. As said in the design stage, an online survey was embedded in the StoryMap; however, no response was received. Hence, at the end of the workshop, an oral survey was conducted as a more straightforward way of gathering feedback.

In total, all 17 participating educators responded to the survey. 94% found the StoryMap designed for primary school students useful, while 53% found the middle school StoryMap useful. 88% of educators expressed a willingness to use StoryMap as an educational tool in class, while only 35% would use it as a self-exploration tool for students. Of the ten lesson plans developed during the workshop, three included StoryMaps. These three plans were created by five teachers whose students ranged from primary school to college, thereby covering all educational levels.

4. DISCUSSION

The StoryMap for primary school was finished first, which allowed plenty of time for revision and feedback collection. Interestingly, feedback from multiple channels suggested that many viewers, although outside the intended age group, still found the content informative and engaging. Therefore, the potential audience for this StoryMap could extend beyond the original age group.

At the workshop, most educators expressed that they would love to use StoryMap but in class rather than assigning students to browse on their own. Based on this suggestion, some of the pop quizzes could be removed as teachers have a more accurate and dynamic way of monitoring students' learning progress. Similarly, interactive functions designed to retain students' attention might need to be reconsidered, as they can be distractions in class.

The survey results also proved that StoryMap can be a powerful educational tool. However, the way to use it in K-12 lies more in guided, in-classroom activities led by teachers, rather than self-learning.

Another consideration is the time spent on browsing these StoryMaps. Other than the one designed for primary school, the other three are relatively text-heavy. Though it is valuable to integrate all related knowledge in just one StoryMap, it also risks overwhelming students or causing them to lose patience. One potential solution is further testing with a larger group of students, recording how much time they spend on each. Based on these results, an estimated reading time can be added before the whole story and each part.

5. CONCLUSIONS/RECOMMENDATIONS

How to use StoryMap should depend on students' education level, background knowledge and learning objectives. In this project, all the StoryMaps were originally designed for self-directed learning or as a preview before class. However, a more effective approach may be to enable the "duplicate" function in StoryMap, which would allow teachers to copy and revise the content according to their needs. Not all functions and materials used are accessible to educators due to limitations of the ArcGIS StoryMap subscription and copyright issues.

Another possible way is to use the StoryMaps as crash courses for educators themselves, helping them quickly acquire the necessary knowledge and saving time in lesson preparation. After familiarizing themselves with all the content, they can take the

StoryMaps into the classroom. This can help solve the time constraint reported in the 2023 survey.

Because StoryMap has the capacity to integrate information from different fields in just one webpage, it can also be used to present scientific research. Instead of relying on research papers or speakers' presentations, researchers can build StoryMaps to explain their research projects and achievements, adding references in the end. This way, they can ensure the scientific rigor while expanding the influence among the general public.

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