Using Children’s Literature to Develop an Inquiry Mindset and Comprehend the Science Practices-3-8th grades

***Solving the Puzzle Under the Sea: Marie Tharp Maps the Ocean Floor***

Directions: Work with your colleagues and conduct a CLOSE read of the book, ***Solving the Puzzle Under the Sea: Marie Tharp Maps the Ocean Floor***. Identify an example of each *science* and *engineering* practice that Marie demonstrates and include it in the chart provided.

|  |  |
| --- | --- |
| **Science** | **Engineering** |
| **Figure 1: Asking questions and defining problems** | |
| **What does the sea floor really look like?**  **How deep were the oceans?**  **Were there mountains beneath the sea?**  **Or was the bottom mostly flat?**  **Could the sea floor really be mapped?** | **Engineering problem:**  **Scientist knew very little about the bottom of the seas.** |
| **Figure 2: Developing and Using Models** | |
| **“You have to think big, I told myself. I hauled a large table into my workroom and covered it with a huge sheet of paper. To me it was a blank canvas filled with possibilities. I couldn’t wait to get started. I began by drawing the coastlines-first of the Americas, then of Africa. Between the coasts lay my target: the wide Atlantic Ocean.**  **Test hypothetical explanations**  **“Even my friend Bruce refused to believe the new theory at first. But I ran my finger down the map, following the narrow path of the north-south rift at the center of the Atlantic Ocean’s mountain chain. I smiled to myself, remembering that a picture is worth a thousand words. Bruce at last nodded and agreed.”** |  |
| **Figure 3: Planning and Carrying Out Investigations** | |
| **“Next I slowly collected all the soundings available and placed their numbers carefully where they belonged on my map…Pinpointing the soundings helped me slowly understand the shape of the Atlantic’s floor: from its shallow shores to its gradual drop offs where the water deepened, to a long underwater mountain chain-called the Mid-Atlantic Ridge-that ran deep below the surface, north to south.”** | **Engineers identify relevant variables:**  **Possible variables that accounted for differences in the ocean’s depth, mountains.**  **“I noticed something else, something new and important. The depth numbers on my map suggested that a deeper narrow valley divided the seafloor of the mid-Atlantic into two parts.”**  **Collect data for analysis:**  **“Next I slowly collected all the soundings available and placed their numbers carefully where they belonged on my map…Pinpointing the soundings helped me slowly understand the shape of the Atlantic’s floor: from its shallow shores to its gradual drop offs where the water deepened, to a long underwater mountain chain-called the Mid-Atlantic Ridge-that ran deep below the surface, north to south.”**  **“They thought these plates were being forced apart by deep-sea earthquakes and volcanoes that occurred along the plate edges. And because the continents rested on these plates and moved as they moved, the new theory was called “plate tectonics” or “continental drift.”** |
| **Figure 4: Analyzing and Interpreting Data** | |
| **“Each sounding told the ocean’s depth at one point. If the sounding number was say, 16,000 feet, it meant the ocean was 16,000 feet deep right there. And if a nearby point the depth was say; only 8,000 feet deep, the sudden difference between the two numbers meant there was probably a mountain-like peak rising upward. And yes, there are mountains beneath the ocean, just as there are on land.”**  **“I noticed something else, something new and important. The depth numbers on my map suggested that a deeper narrow valley divided the seafloor of the mid-Atlantic into two parts.”**  **“They thought these plates were being forced apart by deep-sea earthquakes and volcanoes that occurred along the plate edges. And because the continents rested on these plates and moved as they moved, the new theory was called “plate tectonics” or “continental drift.”** |  |
| **Figure 5: Using Mathematics and Computational Thinking** | |
| **“Each sounding told the ocean’s depth at one point. If the sounding number was say, 16,000 feet, it meant the ocean was 16,000 feet deep right there. And if a nearby point the depth was say, only 8,000 feet deep, the sudden difference between the two numbers meant there was probably a mountain-like peak rising upward. And yes, there are mountains beneath the ocean, just as there are on land.”** |  |
| **Figure 6: Constructing Explanations and Designing Solutions** | |
| **“At that time, most scientists believed the earth’s surface never moved. The earth, of course, moved around the sun. Yet, the earth’s surface, so these scientists assumed, was fixed, unmoving. Other scientists, though, thought differently. They had an idea, or hypothesis, that the earth’s entire surface was divided into several gigantic parts, or “plates”. They thought these plates were being forced apart by deep-sea earthquakes and volcanoes that occurred along the plate edges. And because the continents rested on these plates and moved as they moved, the new theory was called “plate tectonics” or “continental drift.”**  **\* “The Plate Tectonic model of the Earth is supported by multiple independent lines of evidence-magnetic stripes in rocks showing sea-floor spreading, the global distribution of earthquakes and volcanoes, comparable fossils found on widely separated continents and satellite measurements.” September 9, 2013-https://www.google.com/search?** |  |
| **Figure 7: Engaging in Argument from Evidence** | |
| **“Was the new theory true? I believed it was! My map, showing the deep crack, or rift, running between the mountain peaks of the Mid-Atlantic Ridge, was telling me so.**  **“As I continued working, others wandered in and out of my room, arguing about continental drift. Was it true? Yes, no, yes, no. (Scientists are like that. They question everything. Nothing is for sure-until it’s really for sure.)** |  |
| **Figure 8: Obtaining, Evaluating, and Communicating Information** | |
| **Marie Tharp was determined to make a contribution to science. She looked for something that really excited her, something that might lead to a new idea in the world of science. She worked with her colleague, Bruce Heezen. Both of them were interested in “breaking new ground.” A conversation with one of her teachers in college led to her interest in the ocean’s surface. She and Bruce asked questions like, *‘How deep were the oceans?, Were there mountains beneath the sea?, Or was the bottom mostly flat?* They wanted to map the ocean floor. They started with researching the work of other scientists who attempted to measure the depth of the oceans.**  **Marie’s research about the depth of the ocean led her to the work of others who made attempts to measure it. She learned about the work of how sailors used ropes and how scientists used machines that sent sound waves from a ship to the seafloor and back again. Marie discovered that the time it took the echoes to go and come bouncing back enabled the scientists to measure the depth at various points.**  ***“As time passed, more soundings were made, including some by my friend Bruce. And these soundings gave me my starting point.”***  **Marie constructed a model of the ocean floor beginning with a large blank canvas. She drew the coastlines-first of the Americas, then of Africa. Her interest was between these coasts: the wide Atlantic Ocean. She collected the soundings and then placed the numbers on the map where they belonged.**  **Marie analyzed these soundings and began to fill in her map. She remarked, “Each sounding told the ocean’s depth a one point. If the sounding number was say, 16,000 feet, it meant the ocean was 16,000 feet deep right there. And if at a nearby point the depth was, say, only 8,000 feet deep, probably a mountain-like peak rising upward.” The pinpointing of the soundings helped Marie to understand the “shape of the Atlantic’s floor: from its shallow shores, to its gradual drop offs where the water deepened, to a long underwater mountain chain-called the Mid-Atlantic Ridge-that ran deep below the surface, north to south.” She also used colors on her map to show similar depths-shades of brown, blue and green.**  **Marie’s research led her to a new discovery. “The depth numbers on my map suggested that a deeper narrow valley divided the seafloor of the mid-Atlantic into two parts.” This led to the discovery of plate tectonics-the continents rest on the plates and as the continents move so do the plates. Scientists had hypothesized that the plates were forced apart by deep-sea earthquakes and volcanoes that occurred along the plate edges. Marie’s map was showing this to be true.**  **To communicate this information Marie and Bruce had a landscape painter to help with the final printed version of the map that Marie constructed. “I still remember the first time I saw it-with its rich colors, many markings, plains and peaks.” The map was published and was hung in museums, schools and on walls in people’s homes. Because of the work of Marie Tharp we know what the bottom of the ocean looks like.** | |