

Testimonial by Angela Carcione
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As an instructor for Summer Rise, a free summer school alternative for students in NYC public schools this past June, I was faced with a challenge: After a year and a half outside of a classroom, students were filled with angst about entering school buildings for the first time. The DOE envisioned a fun, enriching program to re-engage students that would combine aspects of summer camp and summer school in a safe way, but no curriculum, training, or programming was offered to teachers who would be spearheading this new initiative. In a world of COVID learning, I knew student work would have to be done independently because of social distancing, so couldn't rely on shared materials. Furthermore, I needed assurance that if our building shut down, our lessons could continue virtually. Lastly, after a year of planning virtual instruction while working from home, I was hesitant to have to "re-invent the wheel," writing more technology-based curricula in the week I had between the end of the school year and the start of Summer Rise.

Left to our own creativity and resources, I decided as a former Entomology and Wildlife Conservation major that I would introduce my students to a "Wonderful World of Wildlife" curriculum. I needed an immersive, engaging, and safe way for my students to explore the benefits of wildlife, but that didn't require my students to leave the building due to pandemic-related restrictions. When I heard Dr. Mandë Holford, Associate Professor at CUNY Hunter College and The CUNY Graduate Center, and research associate at the American Museum of Natural History, was offering a free online lecture about snail venom, I immediately registered. In that lecture she discussed researching how a marine snail's venom disables prey by interfering with cell signaling, providing insights into cellular physiology and informing efforts to develop new medical therapeutics. Dr. Holford also mentioned how her research had inspired *BioDive*, a 5-module digital experience for middle schoolers. When Dr. Holford offered a free trial for the *BioDive* platform, I knew this was my solution for fun, curriculum-aligned lessons that I did not have to write or create myself.

BioDive came fully-loaded and ready to implement immediately. *BioDive* is an NGSS-aligned immersive experience where middle school students act as marine biologists to investigate the delicate ecosystems of venomous marine snails. Students complete activities on personalized websites (called digital science journals) with virtual reality expeditions that can also be done on the website, or on mobile phones with cardboard headsets for a more immersive experience. Educators have a dashboard where they can see all of their students' work.

Using *BioDive* allowed my students to engage in a virtual reality marine mission to uncover fascinating organisms, and explore how scientists like Dr. Holford use research on snails to develop non-addictive pain management pharmaceuticals and cancer therapy. My students had multiple opportunities to view the anchoring phenomena of venomous marine snails stunning and eating prey both through videos of the snails and in the virtual reality component. Those experiences lead to discussions about food webs and energy pyramids (Image 1). Students dove deeper into food chains and predator-prey relationships as they completed activities where they drag-and-dropped organisms into the correct trophic levels on an energy pyramid. Students learned a slew of scientific vocabulary, such as "Producer," "Primary Consumer," "Secondary Consumer," "Autotroph," and "Heterotroph." Students also learned how to classify and compare ocean zones, and predicted which zone various organisms lived in based on their prior knowledge (for example, predicting that whales lived near the surface pelagic zones because they

are mammals and breathe air). Furthermore, by making observations during their virtual reality dives, students learned how to identify different aspects of marine ecosystems and practiced asking questions to guide further inquiry. I was able to address misconceptions during this time, such as explaining to students why coral and sponges are actually part of the animal kingdom. Students were also provided with digital news articles which offered more context about where the “killer” snails live, and why researching them is important to human beings. Along the way, I was excited that the platform emphasized the importance of protecting marine ecosystems. I realized that this was the future of science learning: using concrete, relevant and exciting examples of cutting-edge research that our students will one day enter the workforce to expand on.

For teachers that might feel hesitant about taking on such a novel platform for fear of having to do more work or learn a new software, I can assure you that it requires little work on your end. *BioDive* was an easy resource to learn how to use and implement in the classroom. Students sign up with their own accounts, and their digital science journals are auto-graded. I could easily track their progress from my teacher account, giving me more time to circulate and have individual conferences with students as they worked through the pages. We used the web virtual reality instead of the app on mobile phones, so no extra equipment was required (Image 2). We worked through the 5 modules over about 3 weeks, mixing in other activities and discussions along the way. Some days we were self-paced, while other days we completed journal pages and watched videos together.

BioDive was truly an immersive experience. My students remained engaged while covering rigorous and important science topics, and incorporating technology that did not feel like just staring at a screen. My hope was that students would be encouraged to pursue STEM careers and niche areas of research through their experience with this unique scientific narrative, and through meeting a community of diverse scientists through the videos shown on the platform. I do believe it achieved that goal, and I am excited to continue using the platform in the future.



Image 1: A student learns about transfer of energy between trophic levels using an energy pyramid in the BioDive digital science journal



Image 2: A student navigates through an underwater scene to observe venomous snails stunning and eating different kinds of prey