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# Aquatic Adventures Academy

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Water is essential for life. Without water, the biosphere that exists on earth wouldn't be possible. Nicknamed the "water" planet, Earth is covered by one of our most precious resources. The theme of water seemed an obvious choice for a project spanning three years in a middle-school students study.

Students grade 6-8 will engage in aquatic activities specific to their grade level and the required educational standards. Each activity will be developed with specific community agencies in mind. Each of the activities will include opportunities for students to work with and learn from practicing scientists.

For example, as a beginning investigation in 6th grade (Phase 1) students will establish and maintain an aquarium habitat in their classroom with the future intent to receive organisms from their local aquarium. As students follow the guidelines developed by water quality specialists from the Newport Aquarium in Kentucky, they will manipulate variables associated with appropriate cycling of their tank in preparation for those organisms. As required by the National Science Standards for middle grade students:

“Students should develop general abilities, such as systematic observation, making accurate measurements, and identifying and controlling variables. They should also develop the ability to clarify their ideas that are influencing and guiding the inquiry, and to understand how those ideas compare with current scientific knowledge. Students can learn to formulate questions, design investigations, execute investigations, interpret data, use evidence to generate explanations, propose alternative explanations, and critique explanations and procedures.”

Guided by their classroom teacher, students will identify and solve problems with the tank as they take daily measurements of the water. Clarifying their ideas, formulating questions and executing those ideas will be an essential part of this process. Helping them will be local scientists, answering their questions and responding to their observations logged on the Academy website.

Later, students will travel to their area aquarium to view the cycling and maintenance process on a gigantic scale as they tour the water treatment facility that supports the aquarium organisms. Additionally, students will travel to visit an outdoor field station where scientists deal with indigenous species in an aquatic setting.

Bridging all these activities will be the continuous, daily monitoring of their classroom tank as organisms are received, they grow and produce young. Detailed data will be kept and collected as a means of problem-solving issues that occur. The National Science Standard for this activity reads:

“The number of organisms an ecosystem can support depends on the resources available and abiotic factors, such as quantity of light and water, range of temperatures, and soil composition. Given adequate biotic and abiotic resources and no disease or predators, populations (including humans)



increase at rapid rates. Lack of resources and other factors, such as predation and climate, limit the growth of populations in specific niches in the ecosystem.”

Beginning with a classroom tank similar to the one they maintained in 6th grade in Phase 2 (grade 7) students will continue their investigation of the aquatic portion of Planet Earth. Joining forces with their local sanitation district and local water district, students will investigate the processes that occur as wastewater is dealt with and how ground water is prepared for human consumption. Speakers from both those agencies will travel to the classroom to act as investigation leaders and resources. With help from those scientists, the students will develop a working model of how humans benefit from and impact the water cycle. The National Science Standard for this activity reads:

“Water, which covers the majority of the earth's surface, circulates through the crust, oceans, and atmosphere in what is known as the "water cycle." Water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow, and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground.”

Additionally, students will travel to a local wildlife or environmental sanctuary containing aquatic habitats. Prior to the trip, teams of students will develop a hypothesis to investigate. Using appropriate technology (electronic probes, computerized water testing equipment, etc.) the teams will collect necessary data for their investigation. Two of the many National Science Standards that apply are:

“The use of tools and techniques, including mathematics, will be guided by the question asked and the investigations students design. The use of computers for the collection, summary, and display of evidence is part of this standard. Students should be able to access, gather, store, retrieve, and organize data, using hardware and software designed for these purposes.”

“The instructional activities of a scientific inquiry should involve students in establishing and refining the methods, materials, and data they will collect. As students conduct investigations and make observations, they should consider questions such as "What data will answer the question?" and "What are the best observations or measurements to make?" Students should be encouraged to repeat data-collection procedures and to share data among groups.”

Finally, in Phase 3 (grade 8) teams of students will be involved in the design and building a working ROV (remote operating vehicle). The ROV will be used as a water collection device when students travel to an appropriate outdoor aquatic center to collect water samples as part of a Problem-based learning investigation in their classroom.

Those water samples will be analyzed using the same techniques students have used in Grades 6 and 7. Local scientists will act as advisors when students uncover questions they cannot answer regarding what they find in the water. Appropriate chemical tests will be conducted and analyzed, based on standard curriculum requirements for 8th grade. (pH, dissolved oxygen, nitrates, nitrites, etc.) Students may be challenged to replicate the water conditions in a classroom tank experiment.



A common thread through all the experiences is the urgent need to model the exciting world of work as it relates to scientific careers. Both the National Science Standards and the Project 2061 Benchmarks address the issue in multiple standards. These are a few:

“Scientists and engineers work in many different settings, including colleges and universities, businesses and industries, specific research institutes, and government agencies.”

“Women and men of various social and ethnic backgrounds--and with diverse interests, talents, qualities, and motivations--engage in the activities of science, engineering, and related fields such as the health professions. Some scientists work in teams, and some work alone, but all communicate extensively with others.”

“Scientists are employed by colleges and universities, business and industry, hospitals, and many government agencies. Their places of work include offices, classrooms, laboratories, farms, factories, and natural field settings ranging from space to the ocean floor.”

In every phase of the Aquatic Adventures Academy, students learn about science by doing science. They learn from their classroom teacher, practicing scientists, experts in the field of water, and even amateurs who are passionate about aquatics. Their experiences will be entirely inquiry driven and hands-on in practice.

