

LEARNING ON THE HALFSHELL

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At William E. Waters Middle School in Portsmouth, Virginia, approximately 120 seventh grade students are involved in oyster restoration. Two dedicated teachers, science teacher J. Catherine Roberts and mathematics teacher Margaret H. Duffey, lead the students. The goal of this project is to integrate mathematics and science problem solving into the educational experiences of seventh grade students using cutting edge technology. These students, in partnership with the Virginia Marine Resources Commission (VMRC), the Chesapeake Bay Foundation, and local universities, are involved in biweekly monitoring of oyster growth and water quality, as well as the subsequent analysis of this data. Information from current research and innovative technology is incorporated into the project activities.

The activities involve at-risk, low-income students, many of whom are under-represented minorities in the fields of mathematics and science. Most of our students come from single parent homes with parents employed in blue-collar occupations. Although education is of prime importance in these homes, parents are often unable to provide the significant experiences included as part of this project.

According to the Virginia Marine Resources Commission, the oyster stock in the Chesapeake Bay has declined to less than 1% of its historic abundance. A current Environmental Protection Agency (EPA) Zone Three program initiative is to reconstruct oyster reefs as brood stock sanctuaries. The Chesapeake Bay Foundation is committed to establishing 5,000 acres of restored oyster reefs in both Maryland and Virginia to increase the abundance of oysters from 1% to 8% of historic levels over the next 10 years. Our goal is to involve seventh grade students in the oyster-restoration process and to increase public awareness of this vital environmental issue. To increase the abundance of oysters, innovative technology must be used. Information from the most current research has been incorporated into an interdisciplinary curriculum.

Seventh grade students have built a "Taylor float" from materials donated by the Chesapeake Bay Foundation. The float is placed in the Chuckatuck Creek and filled with seed oysters. Oyster spat for the seed oysters is obtained from a population of oysters in the Lynnhaven River that has survived the viruses Dermo and MSX. Floating cages place oysters in

moving water where food is abundant and away from the bottom where siltation can occur. Oysters grown by this method are less affected by the sediment that can clog their gills, slow their growth, and possibly make them more susceptible to disease. Finally, growing oysters in floating cages can protect them from predation by blue crabs, raccoons, and other animals.

Students monitor water quality and inspect oysters for mortality during their monthly field trips to the Chuckatuck Creek site. Students also document important aspects of the oyster population, such as the changes in the mean size of the oysters. During the school year, the oysters will increase in size from $\frac{1}{2}$ inch to nearly two inches. Ultimately, the monitoring data produced by the students will supply valuable information for evaluating the effectiveness of their restoration efforts. These findings will become part of a database created by the Chesapeake Bay Foundation, thus providing a service for Virginia and for future generations. At the end of ten months, the students stock the oysters on a newly created inter-tidal oyster reef sanctuary in the Elizabeth River.

Growing 2,000 oysters from seed and stocking a local sanctuary enhances the students' knowledge of mathematical concepts through the use of hands-on experience, real-world data collection, and analysis. While in the field, students are introduced to the use of probeware and graphing calculators. They also utilize laptop computers to record data in spreadsheet format. As students review and evaluate cumulative data, they become proficient in graphing data to show trends and in employing slopes to interpolate and extrapolate. The data produced by the students supplies valuable information to the Chesapeake Bay Foundation.

In science classes, students study the physical, chemical, biological, and geological characteristics of the Chesapeake Bay ecosystem. They complete activities to demonstrate the connection between increasing the oyster population and the improved water quality in this environment. In the mathematics classes, students learn proper measurement techniques, data collection on both the computer and graphing calculators, and how best to analyze collected data. These skills, coupled with experimental techniques used in water quality tests, enable the students to make connections between mathematics and science. This project results in increased interest and enthusiasm for these subjects, and prepares seventh grade students for advanced math and science courses. Current research indicates that students entering the workforce of the 21st century need a strong background in math, science, and technology.

The activities of the project were integrated with the Virginia Standards of Learning for math and science. It was necessary, therefore, to check for knowledge and understanding

throughout the project. This was done through teacher-generated tests and alternative assessment activities. Pre- and post-tests on the knowledge of seventh grade science and math skills were also administered to the participating students to assess their progress. These tests indicated an increased knowledge of the Chesapeake Bay environment.

When the students were asked to reflect upon their experiences, they had the following comments to make:

“There are not a lot of oysters; I went on the *Baywatcher* and we hardly pulled up anything.”

“I learned how dirty the Chesapeake Bay is.”

“Before this year, I didn’t know that oysters can clean the bay extremely fast.”

“The bay is important. Oysters are in the bay, and their population is declining.”

“The bay is threatened because the oysters are dying.”

“I know now that we have to help the oysters.”

“We need to start telling people what to do and what not to do to the Chesapeake Bay.”

Because Portsmouth is a poor school system, the two teachers involved in this project seek funding each year to continue the oyster restoration project. Student transportation to the oyster site is needed each year, as well as money for substitute teachers. Grant money allows our students to learn and to actually experience the Chesapeake Bay in its natural setting, as opposed to simply reading about it in the classroom. Since this project addresses a current environmental need and provides a successful learning experience for children, funding from agencies and foundations has not been difficult to get.

Virginia Environmental Endowment, Learn and Serve American, Toyota, and Virginia Power provided funding for the 1999-2000 school year. The following budget reflects the costs for the past year:

<i>Baywatcher</i> field trip	\$300
Classroom materials	\$200
Data collection equipment and water test chemicals	\$250
Marine Science Museum field trip	\$600
Trips to oyster float	\$480
Substitute teachers	\$900
Mathematics and science teacher (5% of time)	\$1,800
Total	\$4,530



INTERVIEW WITH MARGARET DUFFEY

Q: What career path did you follow to reach your present position? Is this what you originally aimed for, or were there twists that brought you here?

A: I never intended to become a teacher. It just sort of happened. Now that I have been teaching for 27 years, I'm glad it happened. I wanted to be a mathematician with the space program. I changed my major to English after two years of college calculus and kept my minor in mathematics. The only English I ever taught was during my student teaching. I taught for four years in Westmoreland County before I got married and moved to Tidewater. I have been at W. E. Waters for 23 years and happily married that many years as well.

Q: Have you been involved in similar programs before? Was there a particular moment or stimulus that caused you to begin this project?

A: I work with a very energetic science teacher, Catherine Roberts. She has been the person who has inspired me to think out of the box and integrate mathematics and science. She and I have been on the same seventh grade team for about ten years now. We started off by having the students do science experiments in science class and then do the follow up calculations in math class. It kind of grew from there. Cathy would find more ways for me to use science in the math class and as a result, I have learned a great deal of science. When the Chesapeake Bay Foundation asked science teachers to volunteer to raise oysters, Cathy did not hesitate to get us involved. It has been a wonderful way to stimulate the students to do mathematics for a good cause.

Q: Have there been any unique or unexpected consequences for you resulting from your project?

A: Every year I am delighted to see the students get into the oyster project. We have some students who have weak mathematics skills, low self-esteem, problems at home, etc. Many times it is these very students who become our "oyster groupies" and become very involved. Seventh grade students need a lot of hands-on experiences and this project really gives it to them. It helps to strengthen those weak math skills and definitely raises their self-esteem. (I wish it could help with the home life situation.) I cannot think of any unique or unexpected consequences resulting from the project. We expect the students to participate, have fun, learn more about mathematics and science and help to clean up the Chesapeake Bay, and all of these things do happen. Not all

students get involved, but then not everyone is interested in this project. The field trips are voluntary, the classwork is mandatory.

Q: Are you able to identify the greatest lesson you have learned and the rewards you have gained through working on the student oyster restoration project? What is the greatest benefit you see coming to students—and teachers—through their engagement with this project?

A: I think I just answered this question in #3. My greatest lesson is that seventh grade students need to be involved. Science teachers have known this fact for more years than most math teachers. When students can see a reason for doing the mathematics, then they take ownership. When students can taste, smell, feel, and see the math, they find a reason for doing it. Sitting in neat little rows, working word problems out of a textbook is not the best way to invite students to love mathematics. By involving them in a project such as oyster restoration, and integrating math and science, the students are sort of tricked into doing the math because there is a real-world need to do it.

INTERVIEW WITH CATHERINE ROBERTS

Q: What career path did you follow to reach your present position? Is this what you originally aimed for, or were there twists that brought you here?

A: I have wanted to be a teacher since the second grade with a few side goals along the way. I of course wanted to be an astronaut in the 60's like almost every other kid, but I wore glasses and was a female so there was no hope. I was also interested in forestry, but at the time women only got desk jobs. Yuck! I have been very satisfied with the school to which I was assigned my first year teaching, and that is what has kept me in education. We are the best kept secret of Portsmouth; great kids, concerned parents, and friendly co-workers. I am drawn to research in the summers because science is also a true love.

Q: Have you been involved in similar programs before? Was there a particular moment or stimulus that caused you to begin this project?

A: We are involved in several environmental projects. Our philosophy is that students should be involved in real-world learning. Community partnerships prepare the students in the life skill of cooperation, which is necessary to accomplish goals. I believe that, rather than ending the lesson with the doom and gloom of what former generations have done to our environment, we should empower young people to be proactive: to get results rather than consequences.

Our partnership with the Chesapeake Bay Foundation put us in the right place at the right time. We were approached to become involved in this project because of our history in environmental work and our relationship with the staff of Chesapeake Bay Foundation. I sail on the Chesapeake Bay and am well aware of the environmental impact of man on this area. I jumped at the chance to "make a difference."

Q: Have there been any unique or unexpected consequences for you resulting from your project?

A: The support of the community has been awesome. Student self-esteem soars as they realize they have been a part of a solution. The community reactions have validated our students as valuable members of that community.

Q: Are you able to identify the greatest lesson you have learned and the rewards you have gained through working on the oyster restoration project? What is the greatest benefit you see coming to students—and teachers—through their engagement with this project?

A: Real-world learning is the most effective process. All students are successful. Students who do not experience success in the traditional classroom benefit the most. The rewards come from seeing the positive change in students who suddenly find they are capable.