

# An innovative approach to teaching marine sciences

by

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**Abstract:** I have argued that the world's oceans constitute a kind of last frontier of development which merits a much larger focus than it is now given in existing elementary and secondary curricula. Secondly, the world's oceans constitute a unique and essential element in our biosphere which modern industrial civilization has been treating indifferently, even callously; that it is high time to raise the level of consciousness in our own and coming generations so as to conserve the natural role of the seas in the maintenance of aquatic and terrestrial life forms. Thirdly, marine education cannot be left as a small part of a standard science curriculum if we are to achieve the goal of a marine-literate new generation following in our footsteps. Both in terms of subject content as well as in occasions of emphasis, marine education must break out of science and become multidisciplinary, polycultural, and coetaneous, bridging generations and cultures with awareness and concern for matters of the sea.

I have also described how we have begun to introduce this philosophy of marine education into the existing elementary and secondary school curricula in the state of California by developing materials for use by the regular classroom teacher. I have also mentioned the exciting results achieved by the second University program, whereby we have been able to generate entirely new materials, as well as entirely new teachers of marine-oriented concepts.

Our progress sometimes seems slow but as we move forward, one step at a time, we are rewarded as we see teachers and students alike becoming curious and saying as Melville, "One knows not what sweet mystery about the sea, whose gently awful stirrings seem to speak of some hidden soul beneath".

Once you could run away from the problems that seemed to confound and confuse life, but now there is no place to hide. If you want a world fit to live in you must fight for it.

—Dashmann

I have a rather simple thesis to present which can be summarized in two or three propositions:

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- 1) For a number of timely and important reasons it is beginning to be apparent that mankind must give greater attention to the sea as a kind of "last frontier" of development.
- 2) In addition to the "frontier of development" notion, since the world's oceans cover about two-thirds of the planet's surface, they play a unique and indispensable role in the maintenance of all life forms presently living and yet to appear. For modern civilizations to continue to use the oceans as a vast dump of industrial wastes, or to harvest to extinction some of the aquatic life forms, is to reveal a callousness so short-sighted, so threatening, that a few leaders have taken up the crusade to preserve and conserve its natural role in the balance of life on earth.
- 3) For these and other reasons, new generations of humankind must be educated from the cradle how to care for the oceans as biosphere, as a cultural and communication medium, as a resource base for biological and industrial processes. We call this creating an "ocean-literate society." It must be done with all urgency, but recognize that such an educational process should not be linked to putting a man on the moon or an instrumented lander on the surface of Mars; that is, we are not advocating a project of a few years involving the temporary expenditure of uncounted millions. Rather, what we are advocating requires a multifaceted and multidisciplinary effort to describe and teach, at many levels and correlated with many subject areas, ocean oriented polyculture, beginning now and continuing for future generations.

### THE PROBLEM OF MARINE EDUCATION AS A SCIENCE

The layout of a marine education curriculum inevitably obeys some philosophy, and I should like to discuss for a minute what seems to have been the underlying philosophy for marine education to date. First of all, it has generally been categorized as a "science" with a fairly heavy emphasis in biology. This has been a very natural development, since there is an easily demonstrated biological and evolutionary bridge between aquatic and terrestrial life forms, and it is generally accepted that life as we know it originated in the sea. There is also an easily demonstrated linkage between oceans and land masses in the meteorological cycle of clouds forming over oceans, rains falling on the land, and rivers returning the waters to the oceans. As the subject matters become more sophisticated, seismic and geological phenomena are shown to be common to sea and land, and the dynamics of wave forms can be analyzed with the tools of physics. There is no doubt that the tools of science yield important knowledge about the sea, but the educator must also consider the audience being reached or excluded, as the case may be.

Think for a minute how school children respond to subject matters which are offered in a curriculum. Already in elementary school the children are making decisions about what is useful, desirable, and possible for them as career choices. They learn fairly early that if they want to be "scientist types," they need to be fairly good at mathematics. If the instructional program in mathematics somehow turns them off and they decide they can't manage it, they tend to gravitate to those subject areas which are less mathematically oriented. Other factors enter into these

choices, to be sure, but most will agree with me that perhaps a third choose careers in the sciences, while the remainder develop other career options. Of those who stay with science, only a small number presently choose the marine aspects of a science career. The result: If we continue to limit (by association) marine education to the science curricula, we are thereby seriously limiting the student population which can be affected by marine-oriented curricula.

As a counter philosophy, we have chosen to define marine education as widely multidisciplinary, polycultural; with associational roots in the arts, humanities, history, literature, social studies and most standard curricular categories. Furthermore, we believe that segments (we call them modules) ought to be designed for presentation on all school levels, kindergarten through high school. The goal is to teach about marine factors in the biosphere from all angles, and at all levels to increase awareness and appreciation of the oceans in the history of man and his civilizations, and to contribute to the goals of exploration, development and conservation of marine resources.

### FUTURE GENERATIONS: MARINE-LITERATE

If future generations are going to be more dependent upon the sea, as is often predicted, then it is already time to concern ourselves with how to go about creating what might be called a marine-literate society. They will face a number of problem areas, a heritage of the last century of industrial society. We are therefore confronted with an urgent problem of educating future marine-oriented planners, engineers, nutritionists, political leaders, developers and the like who can resolve the sometimes conflicting demands between maritime and the more traditional terrestrial concerns.

What are the possibilities of such an education within existing curricula today? Very little—an occasional marine biology class or perhaps a field trip. Curricular concerns in public schools have been turned over to specialists at the district, state or national level. Few parents feel concerned or competent to deal with the content or focus of the subject matter currently taught in the schools. With an already overloaded curriculum, marine-oriented classes have been relegated to the biology department, where only a small percentage of the students actually deal with them in a meaningful way. If we are to create a marine-literate society we cannot afford to wait until these children join the work force, or enter college. They must be made aware now of how the marine environment affects their very existence. It will take more than a biology class or a field trip; somehow marine education must come to occupy a greater and more important segment of school curricula.

The needs which are apparent in marine education today may be analogous to those evident in the general field of environmental education, where it has only recently become evident that clean air and clean water are not resources existing in inexhaustible supply; that it takes careful planning, control, and education of the populace at large to achieve overall goals. And unlike some of the traditional academic disciplines, "environment" is not a field of study with definable boundaries. It is linked to nearly every aspect of modern economic/industrial civilization, and to come to grips with its problems requires a new educational approach.

The task of environmental education is at least two pronged: on the one hand

it is necessary to convey the importance of placing value on the environmental quality and its potential deterioration; on the other is to correct the scientific tendency toward compartmentalized thinking. Because nearly everything we do has an impact on the environment, the campaign to create environmental awareness, some kind of climate for its preservation, must include the utilization of nearly all existing academic disciplines, for these are the current repositories of existing human knowledge about the world. This knowledge needs to be re-examined in the light of some of the problems current usage has created, and goals need revising so as to result in its preservation rather than its untrammelled exploitation. It seems that only an interdisciplinary approach can point up the interrelationships and linkages essential to comprehend and conserve what is necessary to our survival.

As with the environment in general, so with the marine problems in particular, for the oceans constitute an extremely important part of our living environment. We advocate the necessity of a much broader multidisciplinary approach then, because while geology and biology are necessary to marine science, so also are physics, astronomy, navigation, engineering, art, history, literature, political science, nutrition; even poetry and mythology. The ocean has long had a strong influence on the development of a culture. Ancient cultures gave the ocean star billing in their mythologies and theories of creation. From earliest times, the ocean served as a stimulus for cultural development in philosophy, religion, aesthetics, and perhaps more importantly, the development of technology for fishing and sailing. Some of the first tools invented were the hook, the harpoon, and the net to take seafood. One of the first means of travel invented to take advantage of unbounded sea lanes was the boat. These in turn led to the development of an understanding of the winds, tides, and the art of navigation. Navigation in turn stimulated the development of a host of complicated means of measurement, permitting travel to distant places, and the opening up of economic markets of trade and interchange between cultures. For millenia the ocean has served as a source of inspiration for artists, writers, and composers. From Homer to Turner to Melville and Debussy the ocean has been a poetic metaphor through which to deepen human understanding of mankind's place in the cosmos.

The Americas need sea people, professionals and technicians who have the knowledge and skills to meet the nation's marine requirements. Career and vocational choices are predicted, to a major extent, on what the person learns in school, usually in grades 1-12. To enlist an appropriate and realistic interest in sea work requires as adequate a grounding as does any land career or vocation, and this is best obtained through the normal process of education.

With this in mind the University of Southern California Sea Grant Program has been developing two complementary sets of supplementary curriculum materials, neither of which is tied to any particular sequence of presentation. Depending upon the teacher's needs and interests, he/she may select from the library of materials the lesson most appropriate for that particular class. From anthropology to Moby Dick, to the comparison of architectural styles of seafaring men, they will find an exciting array of interesting ideas to share with their students.

One set of materials, designed for use by elementary and secondary teachers, is called "California and the Oceans". In order to cover most of the interesting and important aspects of the oceans, we have divided these materials into six sections: The Physical Ocean (Wet, Wild, and Deep), The Biological Ocean (Hello Down There! ), Marine Ecology (You Scratch My Back and I'll Scratch Yours), Frontiers

of Research (Innerspace Explorers), Ocean Management (Let's Make a Deal), and the Economic Sea (The Waiting Treasure). Teachers will be able to select a single module from the book and utilize it for the day's lesson.

Let's say that a teacher desires to include some of the new ocean-related materials in a history class. The first step is to look through the lesson plans under Social Studies (the broader category within which history is included) wherein there are lesson plans and ideas from the marine series which can be accommodated to the needs of that particular class. Pulling a lesson will be easy and straight-forward since every attempt is made to have each lesson as a self-contained module, not dependent upon any certain sequence, easily adaptable to the classroom situation.

A second set of materials is being designed to link into an experimental community educational program under development for the last three years at the University of Southern California. Called the "Joint Education Project" (JEP), it is funded from a number of public and private sources and achieves a basically simple and exciting outcome—it puts the not-yet-graduated university student into an elementary or secondary school classroom on a half day at a time basis to present lessons of interest to him or her to the younger generation coming along behind him in the public school system. It would seem natural that this kind of program would be operated out of a normal school or department of teacher education, and be similar to an internship program. What is different about the Joint Education Project is that it is separate from the school of Education, yet works closely with the Education Department as well as other departments on campus. Professors from many departments across the University are encouraging their students to prepare and present lessons in community schools of the inner city in such diverse fields as literature, art, history, anthropology, political science, psychology, as well as in association with regular science departments such as geology, biology and the like. This project has turned into a real "winner" for the University, with excellent reception in the community schools, excited university students who feel that they have done something worthwhile during the semester's classes, and turned-on children who are their audiences in the local school classrooms.

Our marine-oriented contribution to this program is the design and production of what we call "Idea Books" to assist university-level teachers and their students in the preparation of lesson materials linking ocean-related concepts with such diverse fields as literature, art, history, anthropology, political science, and the like. It works like this:

- 1) A university professor learns about the program through circulars or word of mouth, and contact is made with our offices, details are explained, and materials shared.
- 2) The professor outlines the program to his class at the beginning of the semester, giving the students the option of forming a team and making a series of presentations in a local elementary school as an integral part of the class assignments, in lieu of a term paper, perhaps.
- 3) Two or three students form a team, and in consultation with their professor, turn to the "Idea Books" for themes, topics, activities, resources, etc., useful in the development of their own teaching materials. Each team makes six presentations in a local school classroom during the course of the semester, using a variety of materials and presentation techniques. Their work is constantly monitored and

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evaluated by a JEP representative as well as the classroom teacher and students.

The payoffs are impressive; the classroom teacher is delighted to receive the help of a team of visiting teachers, the children hear new material presented in innovative ways, and the youthful university students have the pleasure of participating in something clearly worthwhile and which gives immediate positive reinforcement in the dialogue with the children. Through the use of these Idea Books, we have found a way to introduce marine education immediately into elementary schools in a way such that both teacher and listener are being made aware of the undeniable importance of ocean-oriented knowledge.