EDITORIAL

On the Technological Requirements of Marine Education

A gap appears to exist between marine scientists and oceanographers. There is a need to fill this gap, to communicate the research findings of marine technology to educational institutions and users. We look to the sea for many of our basic needs such as minerals, fresh water, drugs, recreation, and indeed for living space itself. There is a need for an educational curriculum to disseminate knowledge, to promote marine education, to create an understanding, and correlate this understanding of the oceans more closely to society by using the techniques developed on land based on our experience at sea (UNESCO, 1984).

Synoptic observations are common to oceanographic researchers. Oceanography is progressing from boats, to ships, manned buoys to unmanned stations, on-board data storage to transmitting buoys, and (maybe) from floating factories to future ocean cities. Engineering and technology can easily establish a link between science and society. To disseminate the knowledge widely, we have to seriously promote education about the oceans and seas around us, by finding out ways the sea touches people by providing physical, intellectual and cultural needs. In addition to the tremendous advances of technology on land and in aviation, marine technology is also developing at a rapid pace.

METHODOLOGIES

An urgent need is being felt to promote larger student involvement and provide adequate encouragement/equipment in marine educational programmes throughout the world. The potential scientific educational benefits anticipated are enormous. However, the operational resources required to obtain these benefits are presented in the following paragraphs.

With the comprehensive combination of the needs of marine science education to marine technology, there are oceanographic data gathering attention on the need for a global automatic data acquisition forum (from different sites at sea to the data centre). With the advancement of knowledge in the field of oceanographic instrumentation, marine educational programmes have received a new direction. Courses in marine instrumentation under various categories (*viz.* measurement of marine meteorological and physical oceanographic parameters, wave measurements in the ocean, methods of exploring the ocean floor, marine geophysical and biological measurements, oceanographic data buoys, and remote sensing of the oceans), are gaining importance in this field.

The main demands of the measurements call for measurement skills in all phases of marine science. In particular the observations (DESA and NAYAK, 1984) include: physical (temperature [air, sea], barometric pressure, solar radiation, wind speed and direction, current speed and direction, tides); chemical (pH, dissolved oxygen, salinity [conductivity, temperature and depth], density, nitrate, nitrite, silicate and phosphate levels, hydrocarbons); biological (chlorophyll, fish finders); and ocean engineering (wave period, height, direction). In addition, there is a need for an international oceanographic data centre because of the large amount of global marine data available today in various national marine laboratories and data centres.

As pointed out by DELLA *et al.* (1980), we cannot keep abreast of any technological field unless strong foundations in education and training exist for young oceanographers. It is further emphasised that educators must meet a grave challenge to prepare young people to fulfill the increasingly complex career demands of all aspects of marine technology.

One thing that needs certain emphasis is the fact that marine educational programmes cannot have "holes" in technology acquisition plans. One of the technological developments which will be highly useful in any marine educational programme is to maintain the level of contact, particularly with present-day expanding horizons and geographically separated organisations. Video conferencing, for example, can literally enable us to be in two places at once and with most teleconferencing systems now being built to international CCITT communication standards, the two connecting places could be almost anywhere (NAYAK, 1987). It is now a possibility to discuss a situation from an oceanographic platform/laboratory or a station in Antarctica, face to face, with a group of individuals on the other side of the world without ever leaving the classroom. Video conferencing makes it as simple as that. In fact, future international conferences/symposia could enable participation, presentations and discussion facilities for marine scientists from their field laboratories.

Some lessons provide a better understanding of the technological impacts on marine education, *viz.:* (1) well-thought-out methods to identify and specify future marine educational outlooks; (2) to identify and incorporate/include a "leader"/"champion"/"pioneer" who spearheads the marine educational programme; and (3) to enable technology transfer to educational organizations.

In general, the better idea of the scope of marine studies could be illustrated in many ways: listing broad technological needs desired by marine sciences, assigning priorities to the needs, specifying future needs with the desired performance boundaries (such as "marine-grade power sources", "satellite communications", *etc.*), and projecting the desired subsystem improvements. According to BALDWIN (1986), scientific and technological inquiry are the activities that raise the level of technology and permit economic progress. Thus, the responsibility of educational planners is to make universally available the competencies involved in discovering new knowledge, while the responsibility of economic planners is to make universally available the opportunity to participate in applying new knowledge.

As technology advances, the amount of formal education necessary for its mastery increases. The lesson highlighted by Baldwin is that the planning objective is not dictated by any occupational structure, but rather by the nature of technological progress: the more one knows, the more he can learn. Transmitting the ability to adapt to evolving technological opportunities will maximise progress as well as educational excellence, by the growing potential for the better understanding of the oceans for the social well-being of the entire community.

CONCLUSION

Marine educational programmes have greatly benefitted from the new technological achievements and capabilities which include (1) the acquisition of near real-time marine data; (2) the capabilities of communication systems with low-power devices and computerisation at the front end; and (3) the fast response time of marine-grade sensors.

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