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A Novel Teaching Tool for Understanding Coral Destruction

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Purpose: To promote understanding of the coral life cycle and destructive forces in order to modify destructive human behavior.

Background: Coral ecosystems are important sources of food and coastal protection. Corals, just like other creatures, may be destroyed by environmental and biological stressors. Coral lifecycle and current destructive forces are complex subjects often depicted using scientific terminology that is difficult to understand by the lay public. Better understanding of these concepts through dynamic illustrations and interactive teaching could potentially prevent destructive behavior and help protect these threatened ecosystems.

Methods: We provide a novel teaching tool to visually illustrate damage and modify behavior in multiple age groups.

1. We utilized simplified illustrations targeting children (K-1), middle school (6-8 grade) and high school students. Student comprehension is evaluated through teach-back technique. Using this feedback, illustrations are then modified to augment and clarify areas of confusion.
2. A hands-on interactive program was designed using thermochromic painted coral skeletons. Children at an after school program participate in an interactive, hands-on experience utilizing color-changing paint in addition to the age appropriate illustrations. Thermochromic paint changes color (red to white) when exposed to elevated temperatures. Coral skeletons are painted and then submerged in warm water. The color change dramatically illustrates the effect of warmer water on coral bleaching reinforcing teaching points.
3. Simplified illustrations, and thermochromic painted coral skeletons are then used in an education module presenting information to individuals in a high volume tourist resort area.

Summary: Coral reef destruction is an ongoing concern. Many resources are being applied to study mechanisms of damage. However, education of the general public regarding mechanisms of damage, for example avoiding coral-toxic sunscreen use, is also important for real-time prevention of modifiable destructive human behaviors. Development and application of appropriate teaching tools for all age groups will help with coral preservation. The recent advances in autonomous surface vehicle (ASV) design, propulsion, software, and sensors have resulted in a proliferation of vehicles, including optionally manned conversions, for a multitude of missions. These technologies have created new opportunities to develop heterogeneous and collaborative unmanned systems based around smaller, lower-cost, unmanned surface, underwater and aerial vessels. We propose that diesel-electric powered ASVs with modular architectures can incorporate numerous interchangeable sensor payloads and allows one ASV unit to function as a multi-instrument platform to support other offshore operations. With over 30 days at 7 knots endurance capability and over the horizon communications, this technology represents a step change in offshore operations is a cost effective surrogate to the use of Regional Class Research/Survey vessels to deliver the equivalent capability.

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