



Shipwrecks!

Exploring the Lake Bottom
Using a Remotely Operated
Vehicle (ROV)

Lesson Plans for Educators



Lake Champlain

MARITIME MUSEUM

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Title	Design An ROV
Name of Corresponding Unit Plan	Remotely Operated Vehicle
Creator	LCMM
Grade Level	4-12
Content Areas	Science
VT Grade Expectations NY Standards	NY Standards for Math, Science, Technology, Engineering Design • describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects can be changed, fixed, or improved.
Recommended Length/Duration	30-50 minutes
Learning Goals	Students will analyze their experience with the ROV and identify things that could have improved the effectiveness of the robot for exploration.
Description/Sequence	<ol style="list-style-type: none"> 1. Discuss the experience students had with the ROV. <ul style="list-style-type: none"> • What did you see? • How complete was the data collected? • What else would you have liked to know? List these on the board. 2. After a list of possible new information is generated, return to each item and ask how that information could be obtained; <ul style="list-style-type: none"> • What kind of instrument/tool would be needed? • What were possible problems in gathering it? 3. Ask students to think about what they would like to see in an improved ROV?
Assessments	Informal assessment of student participation.
Materials/Resources	Black/white board or overhead projector
Special Considerations	For this activity it is not necessary to limit responses. If an instrument for certain kinds of information is not known (i.e. smell, taste) simply use these as an opportunity to discuss why that is and how the data would be useful if it could be obtained.

Title	Design An ROV 2
Name of Corresponding Unit Plan	Remotely Operated Vehicle
Creator	LCMM
Grade Level	4-12
Content Areas	Science, Language Arts
VT Grade Expectations NY Standards	NY Standards for Math, Science, Technology, Engineering Design • describe objects, imaginary or real, that might be modeled or made differently and suggest ways in which the objects can be changed, fixed, or improved.
Recommended Length/Duration	3-5 50 minute periods
Learning Goals	Students will design their own Remotely Operated Vehicle
Description/Sequence	<ol style="list-style-type: none"> 1. Discuss with students the kinds of data that would be important to be able to collect through a ROV. 2. For each kind of data, identify the kind of instruments/tools that would be needed to actually collect that information. 3. Describe the kinds of things the ROV would need to be able to do to accomplish those tasks. 4. Have students design their own ROV, including all the elements they feel are important. Their design should include: <ul style="list-style-type: none"> • A diagram of the ROV with all working parts and instruments labeled. • An owners manual or advertising poster that describes what the ROV is able to do and how to operate it. 5. Have students share their designs focusing on the “selling points” that make them unique.
Assessments	Project assessment Rubric
Materials/Resources	Diagram paper
Special Considerations	<p>Some students may be interested in creating a model of their ROV as well.</p> <p>Teachers will have to make a judgment as to how fanciful acceptable designs must be. Having an ROV that did not require a tether or an instrument that can smell underwater might be nice, even if students are unable to determine how that could be accomplished.</p>

ROV Design Evaluation Rubric

Name _____

Date _____

	Exceeds Standard	Meets Standard	Nearly Meets Standard	Below Standard
Features	The ROV has extensive improvements to gather additional data.	The ROV has several improvements that would allow it to gather new data.	The ROV has a few improvements that would allow it to gather new data.	The ROV has no improvements.
Design	The new ROV features are plausible, creative, and their function clearly explained in the design.	The new ROV features are plausible and their function explained in the design.	The new ROV features are possible, with limited explanation in the design.	There are no new ROV features in the design.
Craftsmanship	Diagrams are clear and neat, functions are labeled where necessary and fully explained.	Diagrams are clear, neat and functions are labeled where necessary.	Diagrams are clear and functions are labeled where necessary.	Diagrams do not clearly represent the design.

Title	Giving Directions
Name of Corresponding Unit Plan	Remote Operating Vehicle
Creator	LCMM
Grade Level	K-8
Content Areas	Language Arts, Science
VT Grade Expectations NY Standards	<p>NY Language Arts Standards: Speaking and Writing Key Idea2:</p> <ul style="list-style-type: none"> • present information clearly • use a few traditional structures for conveying information such as chronological order, cause and effect, and similarity and difference • use details to explain or clarify information • include relevant information and exclude extraneous material <p>VT W:13 In written procedures, students organize steps of procedures by...</p> <ul style="list-style-type: none"> • Providing a purpose by giving context to let the reader know when the procedure is appropriate • Arrange the steps in a logical manner • Using details and examples to help the reader understand and visualize the process <p>W:14 In written procedures, students anticipate the readers' needs by...</p> <ul style="list-style-type: none"> • Addressing problems that might arise for the reader • Creating a format that is easy to follow
Recommended Length/Duration	30-50 Minutes
Learning Goals	Students will learn to articulate and sequence a procedure in order to accomplish a specific task.
Description/Sequence	<ol style="list-style-type: none"> 1. Have students choose a simple task appropriate to their level of maturity (i.e. sharpen a pencil, tie a shoe, fold a paper airplane). 2. Have students identify the actions necessary to accomplish that task and write directions describing how to do each action necessary to accomplish the task. 3. Sequence the identified actions into the proper order to create a procedure. These should be written down as a set of directions. 4. Have students read their directions to another person who will follow the procedure exactly as directed. 5. Discuss whether or not the procedure was correct, complete, or effective. As a group or individually, revise each procedure so that it is complete and accurate. 6. Discuss how difficult, but important it is to be able to clearly describe how something is to be done when you are unable to be there yourself.
Assessments	Informal assessment of identifying actions and sequencing based on whether the set of directions successfully described the task.

Materials/Resources	None
Special Considerations	It is common for performers to unconsciously fill in procedural gaps in the directions. The teacher may want to perform each task to ensure that the directions are followed exactly as written.

Title	Mystery Boxes
Name of Corresponding Unit Plan	Remote Operating Vehicle
Creator	LCMM
Grade Level	K-8
Content Areas	Science
VT Grade Expectations NY Standards	<p>NY Math, Science, Technology Standards: Scientific Inquiry Key Idea 1:</p> <ul style="list-style-type: none"> • Develop relationships among observations to construct descriptions of objects and events and to form their own tentative explanations of what they have observed. <p>VT S:2 Students demonstrate their understanding of predicting and hypothesizing by...</p> <ul style="list-style-type: none"> · Identifying simple patterns of evidence used to develop a prediction and propose an explanation.
Recommended Length/Duration	30-50 minutes
Learning Goals	Students will use non-visual clues to gather data and draw conclusions.
Description/Sequence	<ol style="list-style-type: none"> 1. Prepare three identical boxes with three different objects in each. 2. Have students sit in a circle or in some other arrangement where it is easy to pass the boxes around. 3. Introduce the activity by asking if students have ever tried to guess what was in a gift box. Ask how they got information on what it might be. 4. Pass the first box around the room and have students use the techniques they identified to gather clues. 5. After everyone has had a chance to handle the box, ask what we know about what is inside. List these characteristics on the board. 6. Once all clues are listed, ask students to hypothesize as to what it might be. 7. After all hypotheses are accepted, open the box and discuss how close people were to the actual object. What was helpful? What was misleading? 8. Repeat with the other two boxes. 9. Discuss how it is often difficult to get all the information we need and guesses must be made based on the information we can gather.
Assessments	Informal assessment based on participation and understanding of key concepts.
Materials/Resources	Mystery Boxes, board/overhead
Special Considerations	Choose familiar objects appropriate for your age group. It is best if they vary in weight, material, sound when rattled, roll verses slide, etc.

Title	Still Life Drawing
Name of Corresponding Unit Plan	Remotely Operated Vehicle
Creator	LCMM
Grade Level	2-12
Content Areas	Language Arts, Art
VT Grade Expectations NY Standards	<p>NY Language Arts Standard 1; Speaking and Writing 2</p> <ul style="list-style-type: none"> • produce oral reports • provide references to establish the validity and verifiability of the information presented • organize information according to an identifiable structure, such as compare/contrast or general to specific • develop information with appropriate supporting material, such as facts, details, and exclude extraneous material • use a wide range of organizational patterns • support interpretations and decisions about relative significance of information • revise and improve early drafts by restructuring, correcting errors, and revising for clarity and effect
Recommended Length/Duration	50 minutes
Learning Goals	Students will gather information collectively to create a still life drawing of an arrangement they must observe in a remote location.
Description/Sequence	<ol style="list-style-type: none"> 1. The teacher will prepare a still life arrangement in an adjoining room or hidden by a curtain or wall. 2. Describe how underwater exploration often requires many visits to the study site. Each visit may focus on a specific area or detail of the site. 3. Divide the class into research teams of 5-10 students. Each group should have a large sheet of paper, pencils, crayons or colored markers. 4. Discuss how one member of each team at a time will have a chance to view the still life site for one minute. They then will come back to the team and describe what they see. The team will collaboratively begin to sketch the still life arrangement on their paper. 5. The team can formulate specific questions for their observer to try and answer or confirm earlier observations. 6. Each team member will observe the still life site in turn until the whole group agrees that they have all the details in their drawing right. The number of visits to get the drawing right should be recorded. It is important to emphasize that accuracy is more important than speed. 7. Have each group share their drawing. Identify the things all the drawings have in common and anything that is in disagreement. List on the board anything that the groups

	<p>cannot agree upon.</p> <p>8. Take everyone to observe the still life together. Resolve any of the elements that were in disagreement.</p> <p>9. Discuss what made the activity easy or difficult.</p> <ul style="list-style-type: none"> • What did you get right? • What did you get wrong? • What information did you need? • What questions should you have asked? • What would have made the task easier/more efficient?
Assessments	Informal assessment of the final drawing in terms of accuracy and of the group in terms of collaborative effort.
Materials/Resources	Still life objects, large sheets of paper, pencils, crayons/markers, watch
Special Considerations	The still life arrangement could be either a traditional art arrangement of drape, flowers and fruit, or something more topical of science or social studies research (i.e. a complicated machine, historic artifacts, simulated ship wreck.)

Title	Underwater Exploration
Name of Corresponding Unit Plan	Remote Operating Vehicle
Creator	LCMM
Grade Level	4-12
Content Areas	Science
VT Grade Expectations NY Standards	<p>NY Science Standards: Physical Setting Key Idea 2: Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.</p> <ul style="list-style-type: none"> • explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact <p>The Living Environment 5. Organisms maintain a dynamic equilibrium that sustains life.</p> <ul style="list-style-type: none"> • compare the way a variety of living specimens carry out basic life functions and maintain dynamic equilibrium. <p>VT S:30 Students demonstrate their understanding of Structure and Function–Survival Requirements by...</p> <ul style="list-style-type: none"> · Identifying how the physical structure/characteristic of an organism allows it to survive and defend itself
Recommended Length/Duration	30-50 minutes
Learning Goals	Students will identify problems associated with underwater exploration and possible solutions to those problems.
Description/Sequence	<ol style="list-style-type: none"> 1. Introduce the importance of learning about natural environments and man-made artifacts hidden underwater. 2. Ask students what the challenges of underwater exploration are. List these on the board/overhead under the heading “Problems” (i.e. air, light, cold, remote location, pressure, time) 3. After you have a complete list, take each problem and list possible solutions. Accept all suggestions and later discuss which are practical and which are not under what circumstances. 4. This will lead to a discussion and the introduction of the three common forms of underwater exploration; diving, manned submersibles, remote operating vehicles.
Materials/Resources	Black/White Board
Special Considerations	The sophistication of the discussion can be adjusted for different maturity levels.

Title	Underwater Exploration 2
Name of Corresponding Unit Plan	Remote Operating Vehicle
Creator	LCMM
Grade Level	4-12
Content Areas	Science
VT Grade Expectations NY Standards	<p>NY Science Standards: Physical Setting Key Idea 2: Many of the phenomena that we observe on Earth involve interactions among components of air, water, and land.</p> <ul style="list-style-type: none"> • explain how the atmosphere (air), hydrosphere (water), and lithosphere (land) interact <p>The Living Environment 5. Organisms maintain a dynamic equilibrium that sustains life.</p> <ul style="list-style-type: none"> • compare the way a variety of living specimens carry out basic life functions and maintain dynamic equilibrium. <p>VT S:30 Students demonstrate their understanding of Structure and Function–Survival Requirements by...</p> <ul style="list-style-type: none"> · Identifying how the physical structure/characteristic of an organism allows it to survive and defend itself
Recommended Length/Duration	30-50 minutes
Learning Goals	Students will identify the advantages and disadvantages of the common forms of underwater exploration.
Description/Sequence	<ol style="list-style-type: none"> 1. Introduce the three common forms of underwater exploration. 2. Provide a copy for each student, or copy on the board/overhead the worksheet matrix. 3. Individually or as a group, have students identify the advantages and disadvantages of each type of underwater exploration. 4. Share student answers, clarifying as needed. 5. Discuss when it would be best to use each approach.
Assessments	Assessment of worksheets for understanding of key ideas and completeness.
Materials/Resources	Underwater Exploration Worksheet Matrix
Special Considerations	Individuals or small groups could do research and provide the introduction of the three common forms of underwater exploration.

Student Worksheet

	Advantages	Disadvantages
Diving		
Manned Submersible		
Remotely Operated Vehicle		