Instructional Strategy	Overview of Strategy	Example of How to Use the ESDIL With This Strategy
Case-Based Teaching:	The teacher allows students to formulate their own opinions of a case by promoting group-coordinated research activities, debate, or simulated decision making which allows students to develop valuable reasoning skills. With case-based teaching, students develop skills in analytical thinking and reflective judgment by reading and discussing complex, real-life scenarios.	Introduce case-based lessons with images from the ESDIL collection. For example, provide several images of invertebrate and/or vertebrate fossils. Develop a case scenario in which students must determine whether extinct organisms should be cloned from “ancient” DNA. The ESDIL collection could be used as “evidence” to support student opinions. The movie Jurassic Park might be an appropriate follow-up or introduction to this activity.
Gallery Walk	This instructional strategy gets students out of their chairs and actively involves them in synthesizing important concepts, in consensus building, in writing, and in public speaking. Teams rotate around the classroom, composing answers to questions as well as reflecting upon the answers given by other groups.	Questions that relate to an image obtained from the ESDIL are posted on charts or just pieces of paper located in different parts of the classroom. For example, use concepts with matching images from the ESDIL on topics such as weathering, erosion, and deposition that are naturally interrelated. Although students logically like to categorize and classify terms and ideas, this activity will illustrate how the aforementioned processes are indeed connected.
Game-Base Learning	Use competitive exercises, either pitting students against each other or getting them to challenge themselves in order to motivate them to learn.	Create visual “jeopardy” games with images from the ESDIL with categories such as (a) Fossil Identification, (b) Mineral Identification, (c) Rock Identification, (d) Wheel of Earth Science Review, (d) Impact of Humans on Earth and Landscapes, etc.
Graphic Organizers	Graphic organizers (spider map, linear string, fishbone map, double-cell diagram, KWL chart, inverted cone, etc.) provide students with a framework for using information. By visually showing relationships between concepts, graphic organizers connect new information to prior knowledge.	Select a graphic organizer for students to use and print several images of minerals (physical properties such luster, hardness, color, cleavage/fracture, etc.). Have students paste the images in the appropriate location on the organizer. Utilize a KWL chart as follows. Display several mineral images from the ESDIL collection that illustrate a physical property (cleavage/fracture, color, etc.) then ascertain (a) what students know about physical properties of minerals prior to discussing the topic or assigning a reading assignment; (b) ask your students what they want to learn, either as a class or in small groups; and finally (c) determine what your students have learned after the activity. Use an overhead projector, LCD project, or simply hand-out ESDIL images of igneous vs. sedimentary vs. metamorphic rocks, trilobites vs. brachiopods vs. corals, etc. Provide students with a numbered list of characteristics that can be placed in the correct locations of a labeled Venn diagram. The use of Venn diagrams may involve knowledge, comprehension, application, and analysis levels of Bloom’s taxonomy.

Predict, Observe, Explain (POE):	The POE strategy involves showing a class a situation and asking them to predict what will happen when a change is made. POE's can be used to support correct predictions and challenge incorrect predictions. The most important aspect of POE's is identifying and discussing student's concepts.	Utilize images of floods, avalanches, gravity movements, waterfalls from the ESDIL collection and invite your students to predict what the landscape will look like in the future and what it might have been like in the past. Be sure to have the students validate their predictions with plausible explanations or provide evidence from first hand observations.
Problem-Based Learning	An instructional method characterized by the use of "real world" problems as a context for students to learn. Using problem-based learning, students acquire life long learning skills which include the ability to find and use appropriate learning resources. An effective problem must first engage students' interest, and motivate them to probe for deeper understanding of the concepts being introduced. It should relate the subject to the real world, so that students have a stake in solving the problem.	Utilizing an image of a pristine landscape (Catskill region, Hudson Valley region, etc.) determine the pros and cons of preserving land for public use while considering the individual rights of property owners. Students (in groups) organize their ideas, utilize prior knowledge related to the problem, and attempt to define the broad nature of the problem. Throughout discussion, students pose questions, on aspects of the problem that they do not understand. These issues are recorded by the group. Students are continually encouraged to define what they know - and more importantly - what they don't know.
Roundtable Brainstorming	The teacher asks a question that has a large number of possible answers. Each group is given one piece of paper (or transparency). The paper is passed around the group and students write down their responses at the same time stating them out loud. This process continues until the students run out of possible solutions. After the brainstorming, instructors give time for the team to review and clarify their ideas. If needed, the group can present the ideas generated to the rest of the class.	Use an ESDIL image (landscape, erosion, weathering, and geologic history) which requires students to describe in detail the impact of a process or multiple processes. For example, an image depicting stream erosion would require the students to brainstorm about factors such as gradient, stream velocity, particle size, transportation, deposition, discharge, meanders, drainage basins, etc.
Role Playing	In most role-playing exercises, each student takes the role of a person affected by an Earth science issue, such as a volcano or a polluted lake and studies the impacts of Earth science issues on human life and/or the effects of human activities on the world around us from the perspective of that person. Role-playing is simultaneously interesting and useful to students because it emphasizes the "real-world" side of science.	Sort students into groups and provide a different digital image of a fossil. Students will be assigned one of four roles (geologist, oceanographer, atmospheric scientist, or biologist). Have students determine which geologic time period(s) their organism would have lived. They could determine: (a) arrangement of the continents during the time period, (b) associated rocks and sediments, (c) height of sea level during the time of your organism to sea level today, (d) coral reef locations, (e) the type of climate, (f) other associated organisms, etc. Casting the students as experts will likely boost their self-esteem. Specific roles will make the task of actually becoming an expert considerably easier and generate interdependence in the group. Students can gain valuable research skills that will be applicable to other classes. The students summarize the perspectives presented and summarize what they have learned.

Socratic Questioning	During Socratic questioning, the teacher is a model of critical thinking who respects students' viewpoints, probes their understanding, and shows genuine interest in their thinking. The teacher creates and sustains an intellectually stimulating classroom environment and acknowledges the value of the student in that environment. In an intellectually open, safe, and demanding learning environment, students will be challenged, yet comfortable in answering questions honestly and fully in front of their peers.	Reference to the images from the ESDIL collection provides the initial entry point. Thoughtful, disciplined questioning in the classroom can achieve the following teaching and learning goals: (a) model scientific practices of inquiry, (b) support active, student-centered learning, (c) facilitate inquiry-based learning, (d) encourage students to construct knowledge, (d) help students to develop problem-solving skills and (e) help students to develop problem-solving skills.
The Learning Cycle (5E's)	The Learning Cycle is a sequence of lessons designed to engage students in exploratory investigations, construct meaning from their findings, propose tentative explanations and solutions, and relate concepts to their own lives. The first of the five stages involves engaging the students with an event or question.	Utilize a digital image (such as physical weathering, chemical weathering, erosion, deposition, etc.) either in print format or as a projection to introduce a complex topic or lead students into an exploration to develop a concept for which they have some background knowledge. Regardless of the direction, your introduction must engage children, arouse their curiosity, and set a direction for the lesson.
Think-Pair-Share	The teacher poses a challenging or open-ended question and gives students a half to one minute to think about the question. This gives students a chance to start to formulate answers by retrieving information from long-term memory. Students then pair with a collaborative group member and discuss their ideas about the question for several minutes.	Outcrop images (faulted and folded strata, mineral and rock specimens, fossil assemblages, etc.) can be used to bring the field into the classroom. The digital images give students an opportunity to interpret the geologic history of an outcrop or other feature by having them (a) make observations, (b) present interpretations based on their observations and on their prior knowledge, and (c) pose questions for further investigation.
Think-Pair-Square	The teacher poses a problem. Students are given time to think about the question and then form groups of four. Two pairs of two students gather, each pair working to solve the problem. They then re-assemble as four and compare answers and methodologies.	Similar to Think-Pair-Share example.
WebQuest	A WebQuest is an inquiry-oriented activity in which most or all of the information used by learners is drawn from the Web. With the WebQuest instructional model, students use the Internet as a research tool to answer questions, pose hypotheses, and form opinions depending on the specific instructional objectives. The activities motivate especially those students who see the Web as valued part of their culture.	Students will access and search the NYLearns site for your WebQuest. Pick a specific area of research (landscapes, rocks, minerals, geologic history, etc.) and design a basic but focused WebQuest. Be sure to have an overarching question to pose to your students. Describe to students precisely what you want and in what format they should give it to you. Give students detailed sequential procedures for completing the task. Every step should be identified here, including breaking down into groups, student roles, researching, writing, etc. In each phase, probe students with questions that encourage them to employ high skill levels (especially evaluation and synthesis).
Write-Pair-Share	A variation of think-pair-share which gives students a change to write down their answer before discussing it with their neighbor. You might want to collect written responses from each student or pair prior to discussing the question with the class.	Similar to Think-Pair-Share example.

Writing In The Science Curriculum	Incorporating writing into the science curriculum yields enormous benefits. When students write, they must think, forcing them to be active learners. Writing about newly-acquired content strengthens understanding, while allowing students to make connections with prior learning. The writing process can force students to face and seek help with concepts that cause confusion. Writing increases retention, and enhances development of science vocabulary.	Use images of minerals from the ESDIL image collection and solicit students to create a poem about a mineral of their choice (may want to expand by having students research their mineral). The poem will include information about physical properties, formation, locations found (especially in the United States) uses and a personal reaction to the mineral. Incorporating poetry into science teaching expands the curriculum beyond content knowledge or process skills and enhances learning in creativity and affective skills. Print images for the topic at hand and have students write appropriate captions. This activity will encourage students to decipher critical elements displayed in the image and learn to summarize potentially large amounts of information.