<table>
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<tr>
<th>TECHNIQUE NAME</th>
<th>DESCRIPTION</th>
<th>EXAMPLE</th>
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| Discrepant Event | An occurrence that is contrary to what a person expects, and that causes him or her to wonder what is taking place. With proper guidance, the individual will attempt to figure out the discrepancy and search for a suitable explanation for the situation. | **SINKING EGG ACTIVITY**
Materials: Student is given a hard-boiled egg and a glass nearly filled with clear colorless liquid.
Prediction: Student is asked to predict what will happen when the egg is dropped gently into the water.
Discrepant Event: When dropped, the egg sinks halfway down the depth of liquid, and stops.
Explanation: The top half of the liquid is water, which is less dense than the egg. The bottom half of the liquid is glycerol, which is denser than the egg. | Chiappetta & Koballa Jr. (2006), pp. 149-150. |
| Imagery | Use of a picture or diagram To represent concepts and/or Principles that are difficult to Imagine. This provides Students with cognitive aids That make abstract ideas More comprehensible. | **A VISUAL REPRESENTATION OF:**
- CONCENTRATIONS OF IONS IN SOLUTION
| Analogistic Thinking | A analogy forms a relationship between what the learner is familiar with (the analogue) and what he or she is expected to learn, the unfamiliar (the target). the analogy helps the student make connections between what he or she knows and what the instructor wants him or her to know. | **Glynn's teaching-with-analogies model**
1. Introduce the target concept.
2. Review the analogue concept.
3. Identify the features of the target and analogue.
4. Map the similarities.
5. Indicate where the analogy breaks down.
6. Draw conclusions
- **ELECTRICITY** (target) IS LIKE WATER FLOWING THROUGH PIPES (familiar).
| **Simulation (or Simulation Game)** | Simulation: Allows the student to interact with a representation of a scientific model or the natural or physical world, or with a theoretical system. Simulation game: Imitates some reality and gives players the opportunity to act in a real-life role. | Simulation Game
- **WAVE TANKS**
  With water and, sometimes, with lights.
- **INTERACTIVE PHYSICS ™ software.**
| **Positive/Negative Exemplars for Concept Introduction** | Students figure out the attributes of a category that is already formed in another person’s mind, by comparing and contrasting examples (exemplars) that contain the characteristics (attributes) of the concept with examples that do not contain those attributes. These are often presented in exemplar-nonexemplar pairs. The pairs are presented pair by pair. During the process, students write down their hypotheses as to the attributes. Students share their hypotheses. When they agree on the hypotheses that appears most likely, they generate a label for them. Then the teacher supplies the technical label. Students | **WHAT IS THIS LIVING THING?**
**Variation #1**
Teacher presents exemplar-nonexemplar pairs, pair by pair. Examples:
- Hairy skin – scaly skin
- Bear young alive – lay eggs
- Nourish young with milk from glands – Allow
- Young to fend for themselves
**Variation #2**
Teacher presents exemplars and nonexemplars one by one. Each is accompanied by “Yes” or “No.” Examples:
- Hairy skin (Yes)
- Scaly skin (No)
- Bear young alive (Yes)
- Lay eggs (No)
- Nourish young with milk from glands (No)
- Allow young to fend for themselves (No)

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<th><strong>Inductive Activities (Learning Cycle)</strong></th>
<th><strong>WATER DENSITY AND MOTION</strong></th>
<th><strong>Chiappetta &amp; Koballa Jr. (2006), pp. 150-151.</strong></th>
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| In a concrete experience, students encounter the attributes and instances of an idea, followed by discussing and naming the idea. Students obtain data from objects and events, which in turn gives them a foundation upon which to anchor information and to build new knowledge. The phases of the activity are usually engagement, exploration, invention, and application. | Mixing solutions of different densities and colored differently with food coloring.  
**Materials:** Beakers of a) cleat tap water, b) tap water (blue), c) a partially saturated salt solution (green), and d) a saturated salt solution (red).  
**Predicted:** Student is asked to predict what will happen when solution ‘b’ or ”c” or “d” is poured into beaker “a.”  
**Initial exploration:** Students pour separately solution “b” or “c” or “d” into beaker “a” and briefly record the results. Students explore and record the properties of the solutions, including taste. Students attempt to explain their observations.  
**Next exploration:** Students mix up salt solutions of various densities and colors, and pour them into tap water. They record their findings.  
**Invention:** Students devise explanations for their findings. Students discuss their explanations with each other and the teacher. They agree on a generalization of their findings, that is, on a concept or principle.  
**Application:** Students apply their generalization to a related phenomenon in everyday life. For example, to warm air (less dense) and cold air (more dense) masses and the resulting movement. |
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<th>Deductive Activities</th>
<th>IDENTIFYING ACIDS AND BASES</th>
<th>Problem Solving</th>
<th>IS THE CITY DRINKING WATER CONTAMINATED?</th>
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<td>A generalization, like a concept or principle, is first defined and discussed. Then the students have firsthand or concrete experiences to illustrate the generalization.</td>
<td>Presentation of Generalization(s): Students are presented with definitions and properties of acids and bases, based on Arrhenius theory, Bronsted-Lowry theory, and Lewis theory. The attributes of acids and bases are presented. The idea of pH, and various ways to measure pH, are presented. Classification of solutions as acids and bases: students are given several solutions, which they must classify as either acids or bases and find the pH. Post laboratory discussion: Students’ findings are discussed and their understandings are determined.</td>
<td>Students investigate a problem where they must go beyond merely applying a rule to solve it. Students conduct authentic investigations and develop their inquiry skills. They raise questions, plan procedures, collect information, and form conclusions. This may be as short in duration as a class period, or as long as several months.</td>
<td>Following an argument among students about whether the city’s water supply was contaminated, the teacher divided the class into teams of 4-5 students and allowed each team to design a way to investigate whether the city’s drinking water was safe to drink. Most of each group’s investigation was carried out after school. The groups periodically caught the teacher up with their progress and received suggestions. After completion of the investigations, class time was used for each group’s presentation of their findings and conclusions.</td>
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matically. These representations, especially the physical models, provide concrete means to view reality and give science teachers and students a visual image to facilitate learning.

• ATOM
• SOLAR SYSTEM
• BIOLOGICAL CELL
• DNA DOUBLE HELIX

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<th>Science Projects</th>
<th>Science activities that require many hours of student, teacher, and parent involvement. Students identify a problem, propose questions to be answered, design procedures for investigation, gather information, examine the results, form conclusions, and present their findings.</th>
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|                  | • CLASS PROJECTS.  
|                  | • SCIENCE FAIR PROJECTS.                                                                                                                                  |

REFERENCES


