Backwards and Forwards:
Differentiated Science Lessons

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Operational Definition(s)

Think → Pair → Share

A process through which student needs are met
→ different avenues to content
→ different ways to processing, constructing, or making sense of ideas; and
→ different ways to demonstrate understanding.
Differentiate ...

• Content
• Process
• Product
• Environment
Begin with the students

• Get to know them

• Use flexible small-groups

• Offer many ways to explore

• Use informal assessments regularly

• Consider how students learn science
Match instruction to need

- Readiness
- Interest
- Learning Profile
- Multiple Categories
Another way to look at it

from http://www.cast.org/publications/ncac/ncac_diffinstructudl.html
Example #1

- 3rd grade / Learning Styles
- Big idea: some events in nature have a repeating pattern
- Generalization: The water cycle is a repeating pattern
- Allow students to show understanding through different products

from Indiana Department of Education
http://www.doe.in.gov/exceptional/gt/tiered_curriculum/welcome.html
Visual learners

• Read

• Relate ideas to water cycle

• Show understanding through visual:
  –
  –
  –
Auditory learners

• Read

• Present ideas through audio means:
  - Reader’s Theater
  - Play
  - Radio broadcast
  - Blog
Kinesthetic learners

• Create a working model of the water cycle
• Materials:
  - Clear jar
  - Hot water
  - Ice
  - Foil
• Explain what is happening in the cycle
Example # 2

- Curry and Samara matrix
  
  http://www.curriculumproject.com/index.htm

- Pre-planning through a grid of options

- Bloom’s Taxonomy (on x-axis)

- Content on y-axis (specific to big ideas)

- Teacher assigns students in small groups

- May have 2-4 groups working at a time on different learning opportunities
<table>
<thead>
<tr>
<th>Type of Energy</th>
<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Creative Thinking</th>
<th>Critical Thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Types of Energy</td>
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<tr>
<td>a. Forms</td>
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<tr>
<td>b. States</td>
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<td>2. Energy</td>
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<td>a. Energy Transformation</td>
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<td>b. Conservation of Energy</td>
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<tr>
<td>3. Sources of Energy</td>
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<tr>
<td>a. Renewable</td>
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<tr>
<td>b. Nonrenewable</td>
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<td>4. What are the problems?</td>
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<tr>
<td>a. Renewable</td>
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<td>b. Nonrenewable</td>
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<td>5. What are the solutions?</td>
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<tr>
<td>a. Address energy consumption in US, in world</td>
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<td>b. Find new sources of energy</td>
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<td>c. Reduce cost of non-renewable</td>
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<td>d. Increase support for renewable</td>
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<td>e. Green energy</td>
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<td>6. Who has and who uses the most energy?</td>
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<td>a. 1st world vs 2nd world vs 3rd world countries</td>
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<td>b. Variation among US</td>
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<tr>
<td>List the ways 1st World countries and 3rd world countries use energy and technology to conserve or any and share ideas using a</td>
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<td>Explain how energy is used in different places in the US and demonstrate understanding through a/an display.</td>
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<td>Design a system to conserve energy in your community and demonstrate proficiency through a poster.</td>
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<td>Determine whether the amount of energy used by 1st World countries like the US represents a fair share of the energy available and share</td>
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<td>Generate a policy for your school district to use to conserve energy and to invest in renewable energy source and share ideas using a</td>
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<tr>
<td>Justify a required conservation plan in 1st and 2nd country by proposing a strict in the power and balance of energy consumption and</td>
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</table>
Example # 3

• Tiered Assignments / Kathie Nunley
  http://www.help4teachers.com/samples2.htm

• Students contract for and self-select a grade

• Student choices at 3 levels:
  –
  –
  –

• 10th grade Earth Science unit on earthquakes
  – Paltz High School, New York
Objectives for unit

• Understand scales that measure earthquakes.
• Determine the location of earthquakes.
• Recognize the most likely locations of earthquakes and volcanoes.
• Understand how seismic waves can be used to infer information about the earth's interior.
• Know seismic hazards and appropriate precaution.
C Level

Select options to add to 65 pts:

• Take notes on 4 assigned topics (5 ea)
• Create a web page or PPT (5)
• Create flash cards for list of terms (5)
• Select two or three book assignments (5 ea)
• Complete two lab investigations (10 ea)
• Watch video (5) and complete worksheet (5)
• Bring in newspaper articles on topic (5)
B Level

Select one (15 ea)

- Design an Earthquakes Preparedness Brochure
- Internet Lab: Ranking Hazardous Volcanoes
- Computer Lab: Earthquake Patterns
A Level

Select one (20 ea): State your claim, defend it with evidence, and explain your reasoning.

• Is the Richter Scale or Mercalli Scale more useful in learning about earthquakes?
• Are earthquakes or volcanoes more dangerous?
• How concerned do residents of the our region need to be about earthquakes?
Example # 4

• Provide choices through a “Think-Tac-Toe”
• Determine learning goals for students
  – appreciate science as a way of knowing
  – develop skills, abilities, and attitudes to do science
  – demonstrate uses and applications of levers
• Differentiate by number of tasks assigned, time allowed to complete them, individual strengths and preferences of the students
<table>
<thead>
<tr>
<th>Logical/Mathematical</th>
<th>Verbal/Linguistic</th>
<th>Bodily/Kinesthetic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construct a graph or design a chart that explains how a lever works.</td>
<td>Create a bumper sticker about levers. It should be clever and catchy and summarize today’s lesson.</td>
<td>Act out each class of lever with your bodies. There are at least five levers in your body; demonstrate them and explain why they are levers.</td>
</tr>
<tr>
<td>Describe the relationships among lever components using ratios and proportion.</td>
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<tr>
<td>What is mathematical about levers? How do you know?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Visual/Spatial</th>
<th>Interpersonal</th>
<th>Intrapersonal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Draw a cartoon, such as a comic strip, that describes how a very large lever could be used to help someone. Correctly use at least four vocabulary words to describe levers.</td>
<td>Find a partner. Interview your partner to discover what he or she already knows about levers. Together, create a quiz to test your partner's knowledge of levers. Include at least three examples of levers in the quiz.</td>
<td>Write a journal entry describing your favorite lever and explaining how it works. Brainstorm ways you might use this lever at home. Read about the historical use of levers. Are they a new invention or have they been used for a long time? Add some of your new ideas to your journal.</td>
</tr>
<tr>
<td>Create a flipbook that demonstrates the action of a lever.</td>
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</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Musical</th>
<th>Bodily/Kinesthetic</th>
<th>Naturalistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demonstrate with sound what happens to load and the effort when the length of the lever arm doubles.</td>
<td>Given a tongue depressor and a small piece of dowel rod, design a lever that can lift the most weight. Demonstrate your lever to three other classmates.</td>
<td>Create a photo essay of levers in use in everyday life. Label the parts of the levers and explain why they are levers. Describe the patterns you see in the different types of levers.</td>
</tr>
</tbody>
</table>

A Dynamic Duo

• Differentiated Instruction
  —

• Understanding by Design
  —  McTighe
1. Identify desired learning results for the subject and topics you teach.
Determine acceptable evidence of student learning.
3.

Plan learning experiences and instruction based on Steps 1 and 2.
4.

Regard learner differences as inevitable, important, and valuable.
5.

Address learner’s affective needs.
6.

Articulate learning goals clearly.
7.

Use assessment aligned with instruction to make decisions.
Employ flexibility in instructional planning and classroom routines.
9.

Gather evidence of student learning in a variety of formats.
Strategies and Tips

- Make it meaningful
- Make it current
- Give time for practice
- Adjust reading level of materials
- Make it real
- Engage them
- Plan carefully <> (see Planning chart)
Strategies and Tips (con’t)

• Broaden their experiences and choices
• Provide real audiences
• Provide the right amount of challenge (ZPD)
• Deal with what is “fair”
• Be effective and efficient
• Start small and add more over time
• Plan assessment carefully (see chart)
Further Study

Online ASCD Differentiation
  http://www.ascd.org/research-a-topic/
  differentiated-instruction-resources.aspx

DI and Universal Design for Learning
  http://aim.cast.org/learn/historyarchive/
  backgroundpapers/differentiated_instruction_udl

Edutopia (search: “differentiated”)
  http://www.edutopia.org/schools-that-work
References


One final thought ...

Change is a process
not an event.

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