

# Differentiated Instruction in Science

## Science In All Sizes

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# Outcomes for Session

Participants will:

- Examine methods for getting to know your students.
- Explore methods for gathering data.
- Develop a clear picture of differentiation. What does it look like in the classroom?
- Explore what differentiation looks like in science.
- Develop strategies for differentiation in science.



# Guiding Principles

- The teacher focuses on the essentials
- The teacher attends to student differences
- Assessment and instruction are inseparable
- The teacher modifies content, process, products
- All students participate in respectful work
- The teacher and students collaborate in learning
- The teacher balances group and individual norms
- The teacher and students work together flexibly



Tomlinson , C.A. (1999). *How to differentiate instruction in mixed-ability classrooms*.  
Alexandria , VA : ASCD.

# Relevant Research

- 10 Principles that characterize what we know about effective teaching

**Ellis, E. S. and Worthington, L. A. (1994).** *Research synthesis on effective teaching principles and the design of quality tools for educators.* University of Oregon: Technical Report No. 5 National Center to Improve the Tools of Educators.

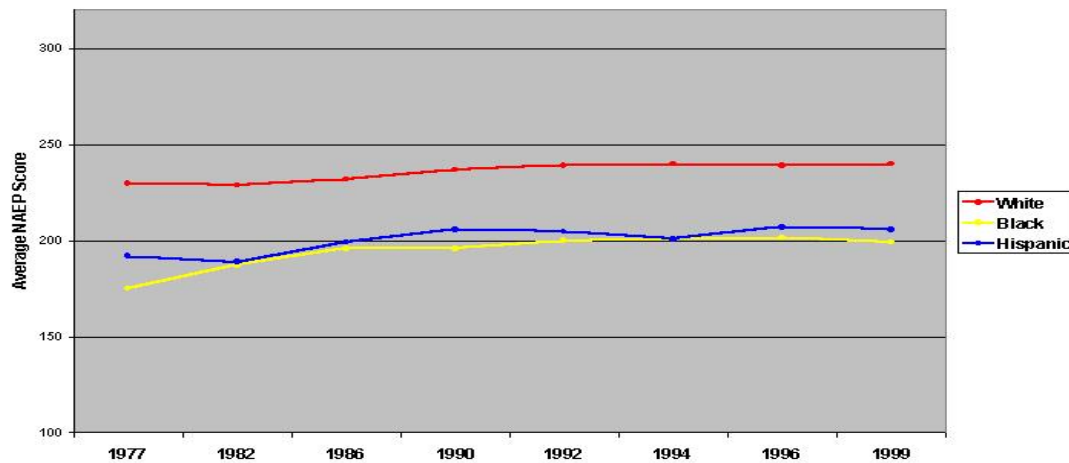
- Authentic assessment research

- Teach-nology (2005). *How to differentiate instruction.* Tutorial from Teach-nology. Retrieved November 28, 2005 from <http://www.teach-nology.com/tutorials/teaching/differentiate/print.htm>



# Achievement Gaps

- The achievement gaps continue to haunt the future of far too many children.



National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1996 and 2000 Science Assessments.



# A Clear Picture of Differentiation

- The Principle of “equafinality”
  - Different pathways to get to the same end
  - Respecting their differences
- There is a close match between student characteristics, instruction and assessment.
- There is a wide diversity of strategies.
- Go slow to go fast. Implement with one lesson and evaluate...then expand.



# Differentiation is not...

- Grading some harder than others
- Giving more difficult questions to different students without adjusting instruction
- Letting those who finish early work on other homework
- Giving more work: extra questions/reports/extensions on same level/concept
- Giving more assignments (don't ask them to do more of what they already know)
- Allowing some students to “get by” without working to their appropriate level
- Less rigorous **concepts** for some than others



Tomlinson, C. (1995). *How to differentiate instruction in mixed-ability classrooms*. Alexandria, VA: Association for Supervision and Curriculum Development. ED 386 301.

# Needed Data for Differentiation

- **Student Readiness**
  - Skill level and background knowledge of topic
  - How well they can work on their own
- **Student Interests**
  - What topics are they interested in (background)
  - What will motivate them (working styles +)
- **Student Learning Strengths**
  - Grouping as individual, small, large
- **Student Environmental Needs**
  - Need more space, less noise, more light? (IEPs?)





# Know Your Students

- Quiz: Do you know your students? (Need class list)



*What teachers should know and be able to do: The five core propositions of the National Board.* Retrieved on November 28, 2005 from <http://www.nbpts.org/about/coreprops.cfm#prop1>

# Examples

- Student survey
  - Grade 4 and above
- Strengths inventory (all levels)
  - Gather data about strengths
  - Use to introduce and group
- Interview another student (Barbara Walters)
- Homepage/collage/box of who I am
- Bulletin Board “This is Me”
- Anecdotal seating charts



# Four Ways to Differentiate Instruction

- Alter the content or topic (key is rigor)
- Alter the process or activities (key is depth)
- Alter the product (key is understanding)
- Alter the environment (key is accommodation)



# Differentiating “How To”

- Key concepts need to be clear and focused
- Generalizations should give meaning and structure to topic
- All lessons should emphasize critical thinking
- All lessons should be engaging
- Lessons should be balanced between student- and teacher-selected tasks and working arrangements



# The Big Idea!!!

“Instruction begins where the students are, not at the front of the curriculum guide”

Tomlinson



# Differentiation is...

- Different ways to explore content
  - Learn and understand vs. “get it done”
  - Focus is on key understandings
- Different ways to understand/make sense of information
  - Active, engaged investigators
  - Focus is on learning preference/style
- Different ways to demonstrate understanding
  - Producers of knowledge
  - Demonstration of knowledge is diverse



# Differentiating Content

- What should the students learn?
- Use of multiple texts and print resources
  - (jigsaw technique works well here)
- Use of computers and other technology
- First person sources
- Learning centers
- Compacting curriculum
- Learning contracts
- With or without manipulatives



# Differentiating the Process

- How do students make sense of the content?
  - Tiered assignments
  - interactive journals
  - learning centers
  - cubing
  - anchor activities





# A Simple Tiered Activity

- Task 1: Find a way to count and sort the objects into two groups (each group should have one special thing in common)
- Task 2: Find a way to count and sort the objects into three groups (each group should have one special thing in common)
- Task 3: Find a way to sort the objects in the baggie into a chart where each item in a row has something in common and each object in a column has something in common. Test your chart by trying to include a new object. (key to periodic table)



# Adjusting Questions

- Journal prompts
- Classroom book of questions
- Capturing good questions
- Hints and helps
- Open ended questions



# Differentiating the Product

- How will students demonstrate what they know and are able to do?
  - Standardized tests
  - Questions
  - Writing prompts
  - Exit tickets
  - KWL charts
  - Paper/pencil tests
  - Drawings.....more?



# Strategy: Multiple Resources

- Same concept, different resources for different students
- Use of multiple texts, websites, and supplementary materials
- Self-selected reading choices
  - For a more challenging read...; For an easier read...
- Use of computer programs



# Strategy: Learning Centers/Stations

- Stations: Students work on various tasks simultaneously (good use of equipment)
  - Invites flexible grouping - not all students need to go to all stations all the time
- Seminars: small groups who learn more about topics (decide ideas to discuss, questions to pursue, timeline of work, final product).
- Examples: Earth and Life (erosion, classification, living/non-living, planets, etc.)
- Index Card Thing: What stations could be used for a current unit? How would you handle the index kids?



# Strategy: Learning Contracts

- Teacher specified components (content and skills)
- Student identified methods for completing tasks
  - allows students to work at an appropriate pace
  - can target learning styles
  - helps students work independently, learn planning skills, and eliminate unnecessary skills practice
- Independent learning agendas (list of things to complete in given amount of time; similar & dissimilar elements)
- “You must do five of the following...” or you need to do enough to add up to “X” number of points
- Example: – Index Card Thing...



# Differentiated Learning Contracts

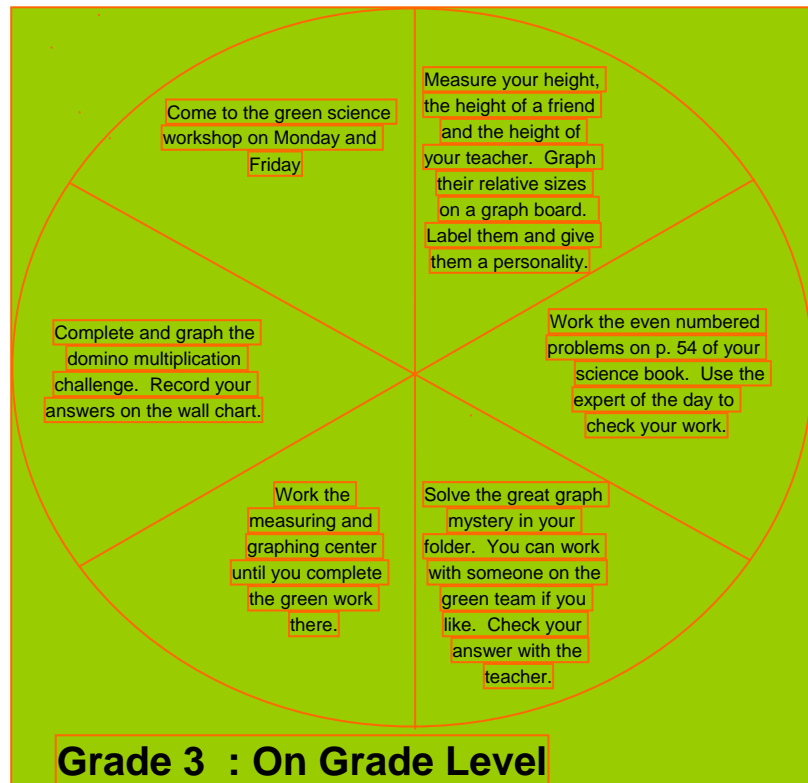


**Grade 3 : Below Grade Level**



- Read the short story "How big is Big"
- Apply: Work with a friend to graph the size of at least 10 different things on the class list (label each thing with how you know).
- Extend: Write a group story that uses measurement and at least one graph. Turn it in to the writing center.

# Differentiated Learning Contracts

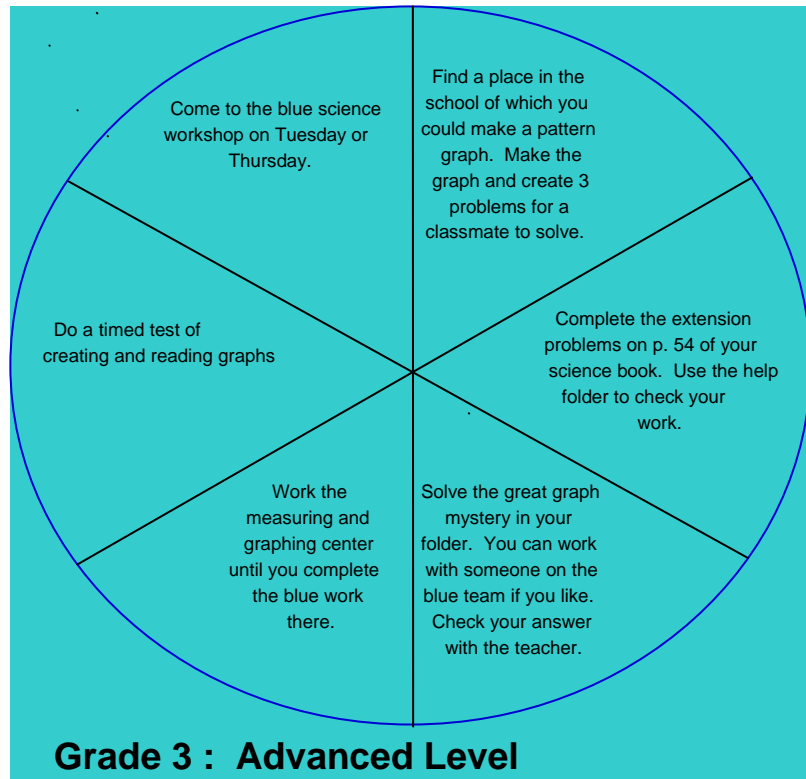


- Read the "Whale Story" or the "Dinosaur Story"
- Apply: Research one kind of whale or dinosaur. Figure out how big it is. Graph its size compared to yours on the graph paper. Label it by name and size.
- Extend: Make a book in which you combine graphs and dinosaurs or whales. It can be a number fact book, a graphing how to book, or a problem book. Instructions are at the author's center





# Differentiated Learning Contracts



- Read the “Monster Math” or the “Top Ten of Everything” book.
- Apply: Complete the graph activities that come with the books
- Extend: Make a top 10 or a monster math book based on things you would like to explore.



# Strategy: Compacting

- Pre-assess and eliminate from their curriculum what they already know
- 3-step process:
  - assess the student for knowledge level and determine what yet needs to be mastered
  - create learning plan and excuse them from what they already know
  - create plans for enriched or accelerated study for “freed-up” time
- Example: direct instruction on cloud types, create a lab to show how clouds are formed.



# Strategy: Tiering

- Tiered sense-making activities and products
  - Instruct at different levels of complexity, abstractness, and open-endedness
  - Different options for products (rolling rubric)
- Classification: Teacher gives groups and criteria then students classify; Students determine groups and criteria then classify (Marzano, best practice)
  - Direct instruction on the characteristics of living vs. non-living things; given guidance in identifying members of both groups
  - Work in teams to identify members of both groups and come up with original examples (Index Card Thing)



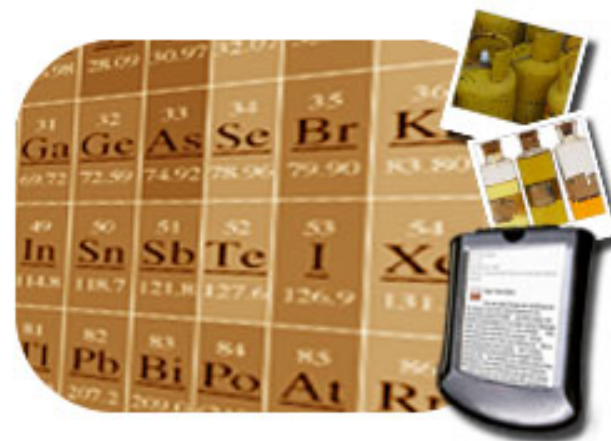
# Strategy: Flexible Grouping

- Placed in many different groups based on readiness, interest, or learning profile. (Study Buddies)
  - Assigned by teacher or chosen by students (Base group)
  - Variety keeps them from being labeled as adv / struggling
  - Assign roles in group based on strengths (reading, taking notes, presentation skills, etc.)
- Examples:
  - Cooperative learning – lab groups (dissolving) ... Pairs prepare and quads conduct lab. (flexible grouping)
  - Rock identification activities – Study Groups, split to get “experted,” then return to group and teach in rotation
  - Skill specific: ask specific kids to head certain groups (ones with skills) then others sign up



# Strategy: Problem-based learning

- Like adult professionals do their jobs
- Relevance & rigor
- Example: Scenarios
  - Elsu Featherstone
  - CCC: Chemistry Consulting Company



# Your Turn

- Select a concept of significance
- Brainstorm the resources you have available to help teach students that concept
- Sort those resources into three categories
  - Helpful for below-grade level students
  - Helpful for on grade-level students
  - Helpful for above grade-level students
- Select activities for 3 wheels and write them in the wheels
- Teach- revise- teach- repeat



# Contacts

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