

## Differentiation for Science

### What is Differentiated Instruction?

Differentiated instruction, also called differentiation, is a process through which teachers enhance learning by matching student characteristics to instruction and assessment. Differentiated instruction allows all students to access the same classroom curriculum by providing entry points, learning tasks, and outcomes that are tailored to students' needs (Hall, Strangman, & Meyer, 2003). Differentiated instruction is not a single strategy, but rather an approach to instruction that incorporates a variety of strategies.

Teachers can differentiate content, process, and/or product for students (Tomlinson, 1999). Differentiation of content refers to a change in the material being learned by a student. For example, if the classroom objective is for all students to identify parts of a cell, some students may learn to label five major parts, while others may learn to label more parts and define the function of each part. Differentiation of process refers to the way in which a student accesses material. One student may explore a learning center, while another student collects information from the web. Differentiation of product refers to the way in which a student shows what he or she has learned. For example, to demonstrate understanding of the food chain, some students may create a three-dimensional diagram, while others create a PowerPoint presentation.

When teachers differentiate, they do so in response to a student's readiness, interest, and/or learning profile. Readiness refers to the skill level and background knowledge of the child. Interest refers to topics that the student may want to explore or that will motivate the student. This can include interests relevant to the content area as well as outside interests of the student. Finally, a student's learning profile includes learning style (i.e., a visual, auditory, tactile, or kinesthetic learner), grouping preferences (i.e., individual, small group, or large group), and environmental preferences (i.e., lots of space or a quiet area to work). A teacher may differentiate based on any one of these factors or any combination of factors (Tomlinson, 1999).

### How Is it Implemented?

Implementation looks different for each student and each assignment. Before beginning instruction, teachers should do three things:

1. Use diagnostic assessments to determine student readiness. These assessments can be formal or informal. Teachers can give pre-tests, question students about their background knowledge, or use KWL charts (charts that ask students to identify what they already **K**now, what they **W**ant to know, and what they have **L**earned about a topic).
2. Determine student interest. This can be done by using interest inventories and/or including students in the planning process. Teachers can ask students to tell

them what specific interests they have in a particular topic, and then teachers can try to incorporate these interests into their lessons.

3. Identify student learning styles and environmental preferences. Learning styles can be measured using learning style inventories. Teachers can also get information about student learning styles by asking students how they learn best and by observing student activities. Identifying environmental preferences include determining whether students work best in large or small groups and what environmental factors might contribute to or inhibit student learning. For example, a student might need to be free from distraction or have extra lighting while he or she works.

Teachers incorporate different instructional strategies based on the assessed needs of their students. Throughout a unit of study, teachers should assess students on a regular basis. This assessment can be formal, but is often informal and can include taking anecdotal notes on student progress, examining students' work, and asking the student questions about his or her understanding of the topic. The results of the assessment could then be used to drive further instruction.

### **What Does it Look Like for Science?**

Science instruction can be differentiated to allow students to explore topics of interest, expand their research skills, and receive instruction on discrete science and inquiry skills. The chart below offers a variety of strategies that can be used.

| <b>Strategy</b>    | <b>Focus of Differentiation</b> | <b>Definition</b>  | <b>Example</b>   |
|--------------------|---------------------------------|--|--|
| Tiered assignments | Readiness                       | Tiered assignments are designed to instruct students on essential skills that are provided at different levels of complexity, abstractness, and open-endedness. The curricular content and objective(s) are the same, but the process and/or product are varied according to the student's level of readiness. | Some students are provided with direct instruction on the characteristics of living vs. non-living things, and are given guidance in identifying members of both groups. Other students work in teams to identify members of both groups and come up with original examples. |
| Compacting         | Readiness                       | Compacting is the process of adjusting instruction to account for prior student mastery of learning objectives. Compacting involves a three-step process: (1) assess the student to determine his/her level of knowledge on the material to be studied and determine what                                      | In a science class, students who already know the process of photosynthesis are given a lab assignment in which they must develop and test hypotheses related to the topic, while other students are given more  |

| Strategy                            | Focus of Differentiation            | Definition   | Example   |
|-------------------------------------|-------------------------------------|--|---|
|                                     |                                     | he/she still needs to master; (2) create plans for what the student needs to know, and excuse the student from studying what he/she already knows; and (3) create plans for freed-up time to be spent in enriched or accelerated study.  | direct instruction on the concept.  |
| Interest Centers or Interest Groups | Readiness Interest                  | Interest centers (usually used with younger students) and interest groups (usually used with older learners) are set up so that learning experiences are directed toward a specific learner interest. Allowing students to choose a topic can be motivating to them.   | <p>Interest Centers - Centers can focus on specific topics in Earth Science, such as classifying rocks or carbon dating.</p> <p>Interest Groups - Students can work in small groups to prepare and debate issues surrounding the origin of the universe.</p>  |
| Flexible Grouping*                  | Readiness Interest Learning Profile | Students work as part of many different groups depending on the task and/or content. Sometimes students are placed in groups based on readiness, other times they are placed based on interest and/or learning profile. Groups can either be assigned by the teacher or chosen by the students. Students can be assigned purposefully to a group or assigned randomly. This strategy allows students to work with a wide variety of peers and keeps them from being labeled as advanced or struggling. | The teacher may assign groups based on student characteristics for a lab in which each group member must take on a specific role. For example, a student who is a strong writer might take notes for the group, while a student who enjoys public speaking might present the group's findings. Students may choose their own groups for another lab in which they will explore the properties of an inanimate object. |

\* More information about grouping strategies can be found in *Strategies to Improve Access to the General Education Curriculum*. Available at [http://www.k8accesscenter.org/training\\_resources/curricular\\_materials.asp](http://www.k8accesscenter.org/training_resources/curricular_materials.asp)

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| Learning Contracts | Readiness<br>Learning Profile             | Learning contracts begin with an agreement between the teacher and the student. The teacher specifies the necessary skills expected to be learned by the student and the required components of the assignment, while the student identifies methods for completing the tasks. This strategy (1) allows students to work at an appropriate pace; (2) can target learning styles; and (3) helps students work independently, learn planning skills, and eliminate unnecessary skill practice. | A student wants to trace his or her family tree and genetic traits. With the teacher's guidance, the student develops a plan for researching family traits and for learning about genetics. The student decides to make a poster of his or her family tree (with graphics representing genetic traits) to present to the class.  |
| Choice Boards      | Readiness<br>Interest<br>Learning Profile | Choice boards are organizers that contain a variety of activities. Students can choose one or several activities to complete as they learn a skill or develop a product. Choice boards can be organized so that students are required to choose options that focus on several different skills.  | Students are given a choice board that contains a list of possible activities they can complete to learn about density. The activities include using a water table to explore properties of various objects, reading about density in the textbook, and watching a video with demonstrations centered around density. The activities are based on the following learning styles: visual, auditory, kinesthetic, and tactile. Students must complete two activities from the board and must choose these activities from two different learning styles. |

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## **References & Resources**

Hall, T., Strangman, N., & Meyer, A. (2003). *Differentiated instruction and implications for UDL implementation*. National Center on Accessing the General Curriculum. Retrieved July 9, 2004 from:

[http://www.k8accesscenter.org/training\\_resources/udl/diffinstruction.asp](http://www.k8accesscenter.org/training_resources/udl/diffinstruction.asp)

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

<http://www.cast.org/ncac/index.cfm?i=2876> – This site contains an article by Tracy Hall at the National Center for Accessing the General Curriculum. The article discusses differentiation as it applies to the general education classroom.

<http://members.shaw.ca/priscillatheroux/differentiatingstrategies.html> - The Enhancing Learning with Technology site provides explanations for various differentiation strategies.

<http://www.mcps.k12.md.us/curriculum/science/instr/differstrategies.htm> - A Web site that lists instructional strategies and techniques that teachers can use to differentiate in the science classroom.