LDOE Louisiana Department of EDUCATION

Including Students with Disabilities in General Education Science Class

March 26, 2013
1:00p.m.

Today's Objectives

- Review critical research findings to guide educators to design science instruction for all students
- Explore instructional design approaches that will promote inclusive practices
- Examine ways to integrate strategies that allow access to science curriculum for students
- Introduce a strategy and resource for collection of progress monitoring data

What We Know…

Among students receiving services under the Individuals With Disabilities Education Act (IDEA) in public schools,

more than two thirds receive their science instruction in general education classrooms.

(National Center for Education Statistics, 2011).

Research concludes…

Students with disabilities benefit educationally and socially when they are educated with typical peers.

However…..

Designing and delivering instruction to students with disabilities in general education classes is challenging for practitioners.

Polychronis, et. al. (2004)

Key Concepts for Educators

- Shift from traditional textbook-based instruction in science to more of an inquiry-based approach leads to improved science education and increased inclusion for students with disabilities. Teachers are encouraged to adopt this innovative approach to science instruction." The National Research Council (NRC, 1996)

- The National Science Teachers Association encourages teachers to use inquiry-based and innovative instruction that focuses on learning for all students. The National Science Teachers Association (2011)

Different meanings for different people….

Pure (Open)Inquiry

- No teacher feedback
- Students decide how to set up investigation
- Students determine problem to investigate

Structured(Guided)Inquiry

- Specific Feedback
- Teacher structures investigation
- Teacher creates problem for investigation

(NRC, 1996)

INQUIRY-BASED LEARNING
Consider the Comparisons …..
Which do you think would be most effective approach for educating students with disabilities?

PURE (OPEN) INQUIRY

- Student may become overwhelmed with information
- Students may have errors within the investigation/experiment
- Create misleading conclusions

STRUCTURED (GUIDED) INQUIRY

- Provides specific feedback
- Provides teacher directed learning
- Allows freedom for students to investigate and discuss while providing organization and supports

Most effective strategy for instructing students with disabilities

"A more structured inquiry approach that utilizes explicit enhancements has been found to be the most effective strategy for instructing students with disabilities."

(Therrien, Taylor, Hosp, Kaldenberg, &Gorsh, 2011).

STRUCTURED (GUIDED) INQUIRY

- Provides specific feedback
- Provides teacher directed learning
- Allows freedom for students to investigate and discuss while providing organization and supports

Common Components of Inquiry-Based learning

1. Students conduct investigations and experiments within lessons

2. Students inquire through problem solving and negotiation

3. Teachers extend student learning beyond a set level of standards

Designing Instruction using evidence based Practices

Content should be designed to:

Engage students

Provide opportunities for discovery and exploration.

Allow students opportunities to experience something in order to make sense of it

Scruggs et al. (2008)

Challenge for Teachers

- Struggle to find ways of providing both functional instruction and ensuring that students with disabilities have access to the same curriculum as their peers.

- Although a student's curriculum does not have to be limited to grade-level standards, it must be linked to standards to be included as participation and progress towards *Adequate Yearly Progress*

Ayers et al. (2011); Yell et al., (2005)

Considering Academic Content

The way to ensure that all students are successful in science is to focus on designing structured lessons based on experiential learning principles

Therrien et al. (2011)

Educators must be familiar with state and national standards.

For example, National Science Education Standards (NSES) Focus on scientific literacy….

a shift from memorization and mastery of scientific content and facts

… to a more general understanding of scientific knowledge

DeBoer (2000); NRC (2000)

Adapt to Incorporate Individual targets

Common Core Standards

To meet the unique needs of the child which result from the child's disability; and to ensure access to the general education curriculum ....IEPs serve to "adapt"

- Content
- Methodology
- Delivery of instruction

Individualized Targets

(34 C.F.R. § 300.39[3]

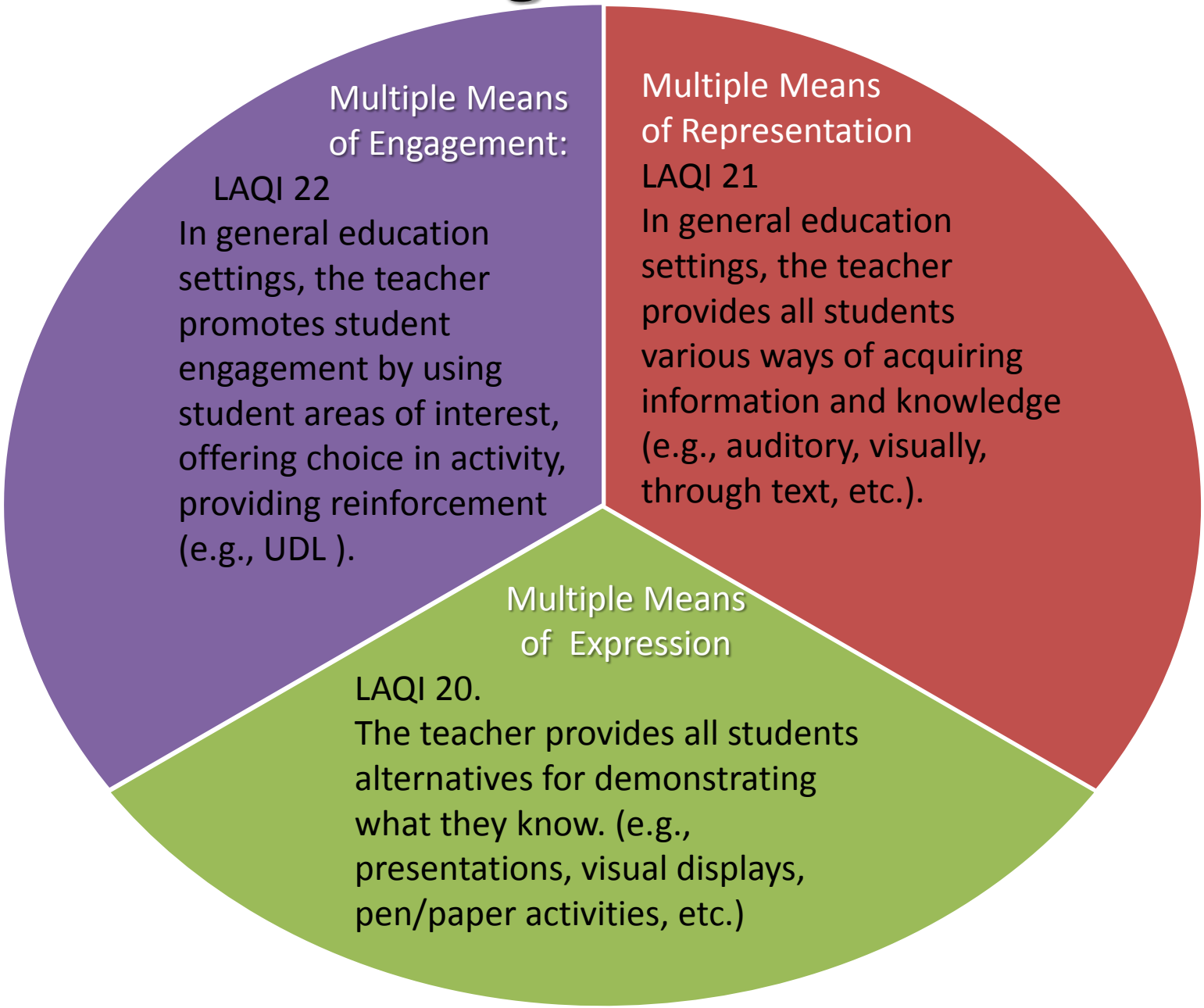
Approach to Instruction

Curricular -We change WHAT we teach
A *curricular approach* treats thinking skills as an explicit curriculum and it demands we develop new content and teach new lessons

Instructional - We can change HOW we teach.
The *instructional approach* treats thinking skills as a process and it demands we teach existing content and lessons using instructional strategies that foster thinking.

UNIVERSAL DESIGN

Universal Design means PROVIDE…



Instructional Delivery

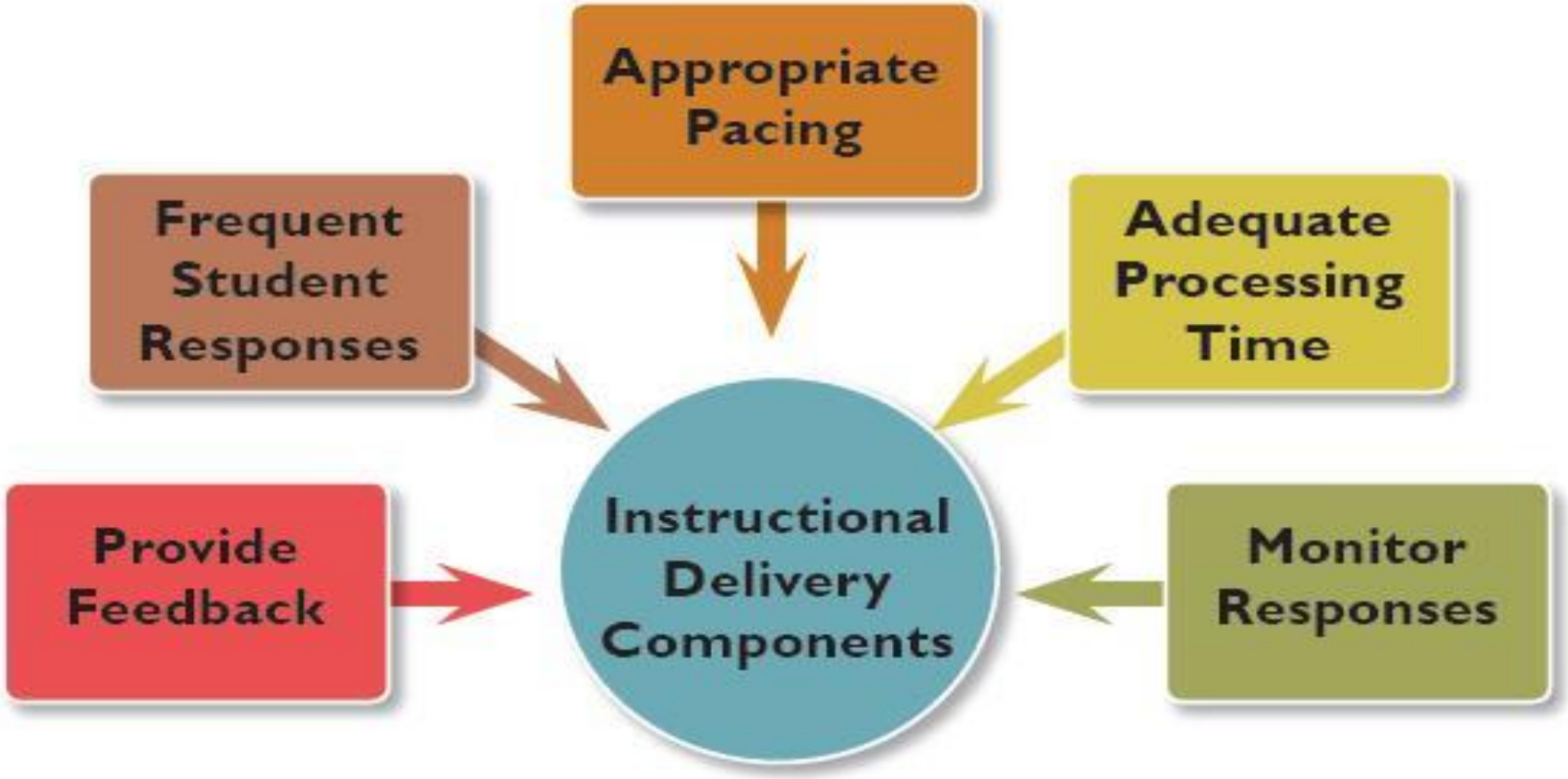


Figure 1. Standard instructional delivery components essential to all explicit instructional episodes (Hall, 2002).

What Individualization is Needed?

Students with disabilities

- Often have skill challenges in the areas of ***Social, Communication***, and ***Behavior***
- Students may tend to have difficulty with inductive and deductive thinking skills, these skills are associated with scientific reasoning
- Independent reading levels are often below grade level
- Have limited knowledge of independent study strategies
- Require explicit instruction on how to study and review for tests and quizzes.
- They need significant practice, repetition, feedback, and reinforcement in order to retain information and generalize skills and concepts

Mastropieri, Scruggs, Boon, & Carter (2001)
Cawley, Parmar, Foley, Salmon, & Roy (2001)

Selecting Individualized Targets

- Identify skills that facilitate the participation of the student with disabilities **in routine daily activities with typically developing children** (LAQI 9);
- Identify skills that build upon the student's **strengths and interests** (LAQI 22);
- Identify skills that will **increase opportunities** to participate in future activities (LAQI 30, 40, 67)

Question???

How can teaching strategies be developed that will allow students with disabilities to receive effective, individualized instruction that fits the typical organizational structures of general education classes and instructional routines?

Embedding goals

Embedded instruction is one strategy that can be used to address this issue!

Polychronis, et. al., 2004

Teachers can blend science curriculum with IEP goals

For example, address individualized Social skill instruction …

- Student can use scientific information to make daily choices
- Engage student in discussions about issues related to science and technology
- Create opportunities for sharing and expression through personal enjoyment and excitement of understanding the natural world
- Challenge student to undertake activities that increase in skill requirements
  - -reasoning
  - -thinking
  - -creativity
  - -decision making
  - -problem solving

(DeBoer, 2000; NRC)

Build Instruction to Provide Functional Science Experience

Embedding *Into*

Activities/Routines

Instruction that occurs within on-going naturally occurring activities or routines without breaking the flow of the routine

Embedding *Between*

Activities/Routines

Instruction that occurs during naturally occurring opportunities such as breaks during activities or transitions from one activity to another

Lesson	Functional Skills	National Standards[a]	
Finding the Factor: Ultra Violet (UV) Protection and Solar Energy • Students learn about protecting themselves from the harmful rays of the sun, what works and what doesn't • Through guided inquiry exploration of ultra violet beads, students identify efficient ways to block the sun and identify when the sun's rays are stronger than others	• Hygiene skills • Fine motor skills • Purchasing skills • Comparison skills • Writing skills • Weather identification skills • Communication skills • Cleaning skills	Earth and Space Science: • Energy in the Earth System (9–12) Physical Science: • Matter, energy, and organization of in living systems (9-12)	Science as Inquiry: • Abilities necessary to do scientific inquiry (all grades) • Understanding about scientific inquiry (all grades)
		Science in Personal and Social Perspectives: • Personal Health (all grades) • Natural Hazards (all grades) • Nature of Scientific Knowledge (9–12)	Writing: Recall relevant information from experiences or gather relevant information from print and digital sources; summarize or paraphrase information
Brushing Teeth Investigations • Students explore oral hygiene through inquiry investigation of other materials • Students compare different toothbrushes, manual and electronic, motions of brushing, types of foods and beverages and their impact on their teeth	• Oral hygiene • Problem solving • Fine and gross motor skills • Purchasing skills • Domestic skills (cooking, cleaning up)	Physical Science: Properties of Objects and Materials (9–12)	Science in Personal and Social Perspectives: Personal and community health (9–12)
			Science and Technology: • Understanding Science and Technology (All grades) • Technology Design (All grades)
		Language Arts: Include multimedia components (e.g., graphics, sound) and visual displays in presentations when appropriate to enhance the development of main ideas or themes.	Language Arts: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.
Cooking up Science from the Past: Fossils • Students investigate the past by creating fossils (can be edible, casts or ornamental) • Students follow recipes/instructions to create fossils • Students compare the fossils to understand organisms from the past in comparison to today	• Cooking skills • Procedural skills • Measuring skills • Fine motor skills • Cleaning skills	Live Sciences: • Interdependence of Organisms (9–12) • Behavior of Organisms (9–12) • Biological Evolution (9–12)	Mathematics: Know relative sizes of measurement units within one system of units
		Physical Science: • Properties and changes of properties in matter (9–12)	Unifying Concepts and Processes: • Change consistency and measurement (All grades)

Adapted: See Common Core State Standards (National Governors Association Center for Best Practices & Council of Chief State School Officers, June 2010); National Science Education Standards (National Research Council, 1996).

Scaffolding

Scaffolds can be viewed as bridges that support the learner:

- Determine the learner understanding and knowledge of topic
- Determine what support is needed

WHERE THE LEARNER IS → **WHERE THE LEARNER NEEDS TO BE**

Scaffolding

By providing just the right level of support, students can move from their current understanding to higher levels of understanding (Vygotsky, 1978).

What Essential Knowledge:

- How do substances combine or change (react) to make new substances?
- How does a scientist characterize and explain these reactions and make predictions about them?

Build the Scaffolding for Students:

- Building on prior knowledge
- Experience: students need a concrete experience that does not involve a color change—this is often mistaken for "chemical change."
- Cooperative learning strategies
- Graphic organizers

Support Instruction

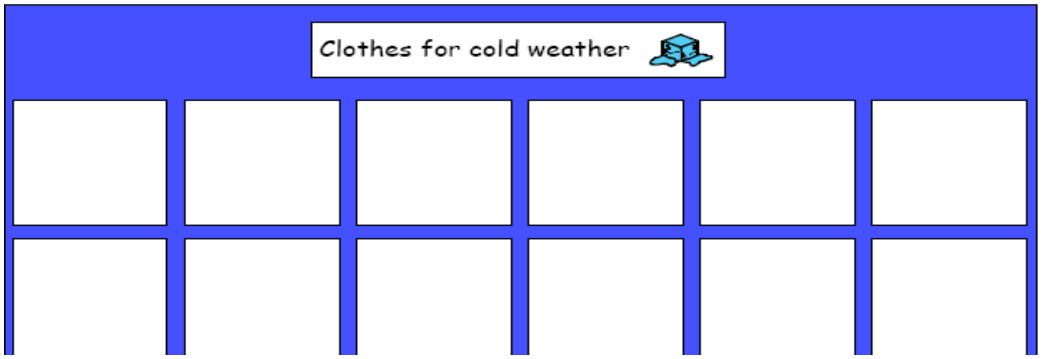
Example:
HINT CARD

Ask yourselves these questions to help determine if you have a chemical change:

Question	What You Might Have Observed	What Is Going On
Did you see the production of a gas?	Bubbles from mixing	The gas is a product formed from the two substances reacting.
Did you feel or collect a temperature change?	The container got warm or if a temperature probe was used there was a change in reading.	Chemical energy is being released (in the form of heat) or being removed (cold)
Did you see a precipitate form?	Clear liquid would become cloudy. In the case of two liquids, a solid suddenly formed.	Two things come together to make something that is not able to be dissolved in the liquid.
Did you see a color change? *Note.* Not the best indicator	Color appears when two colorless liquids were mixed or colored materials become colorless or one color changes to another.	Materials are combining in such a way that it affects how much energy it takes to move electrons around.

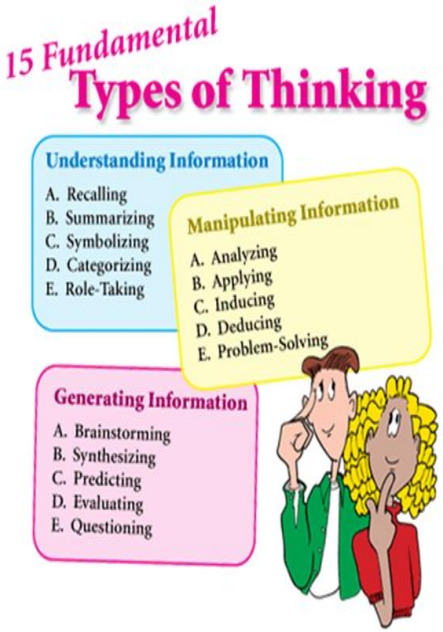
Sort Clothes

This activity includes vocabulary and a sorting board. Get the student to sort clothes based on weather. Some clothes can be worn in cold or warm weather. You may wish to limit vocabulary for a beginning student.



Strategy Instruction

Strategy instruction is well supported by research.



Some examples are:

Teaching students self-monitoring and self-regulation

- -self-scoring problems
- -charting daily scores
- -setting goals
- -monitoring progress

Self-questioning (asking, "Does this make sense?")

Main idea and summarization strategies

Repetitive reading

Mnemonics (highly effective devices for helping students recall difficult-to-remember facts)

(Santangelo, Harris, & Graham, 2008)

Provide opportunities to Experience Learning

Function	Selected Structures
Set	Mix-Pair-Share Single RoundRobin Continuous RoundRobin
Processing	RallyRobin Timed Pair Share RoundRobin
Teambuilding	Team Interview Three-Step Interview
Classbuilding	Corners Similarity Groups
Peer Tutoring	Team Pair Solo Numbered Heads Together Jigsaw Sage-N-Scribe
Authentic Assessment	RallyTable Instant Star Show Me One Stray
Review	Pairs Compare AllWrite RoundRobin Trade-a-Problem Stir-the-Class
Closure	RallyTable Dueling Flipcharts Mix-Music-Meet Give One, Get One

(Kagan, 2002)

http://www.kaganonline.com/index.php

Cooperative Learning

- Small teams
- Different levels of ability
- Variety of learning activities
- Role responsibility

http://www2.ed.gov/pubs/OR/ConsumerGuides/cooplear.html

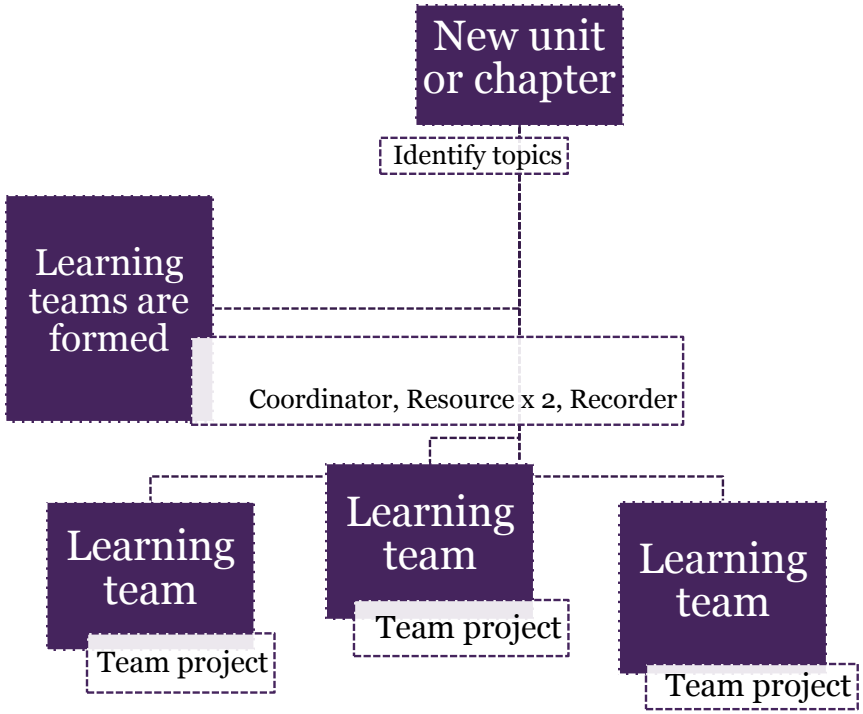
Examples of Cooperative Learning

- Group Investigations
- Student Teams -Achievement Divisions
- Jigsaw II

http://artofteachingscience.org

What do these approaches look like?

GROUP INVESTIGATIONS



STUDENT TEAMS-ACHIEVEMENT DIVISION

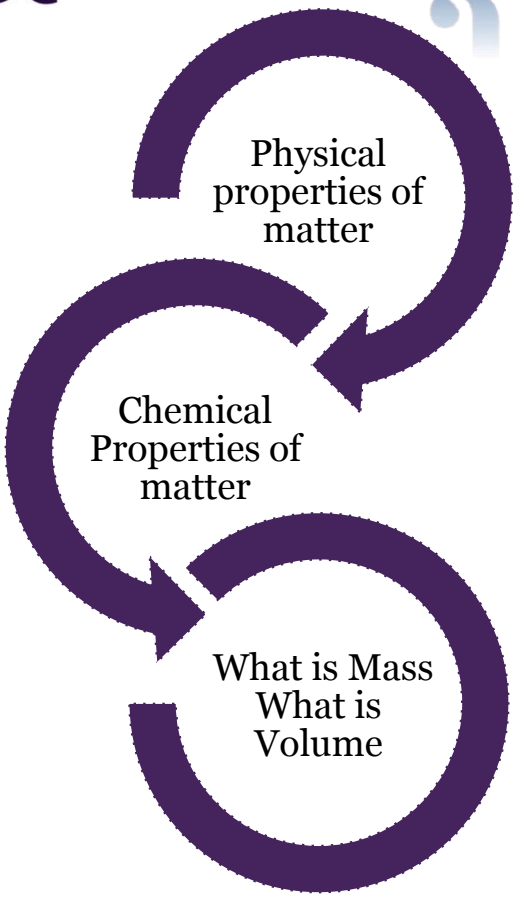
Team study
- Individual test
- Team Recognition

Team study
- Individual test
- Team Recognition

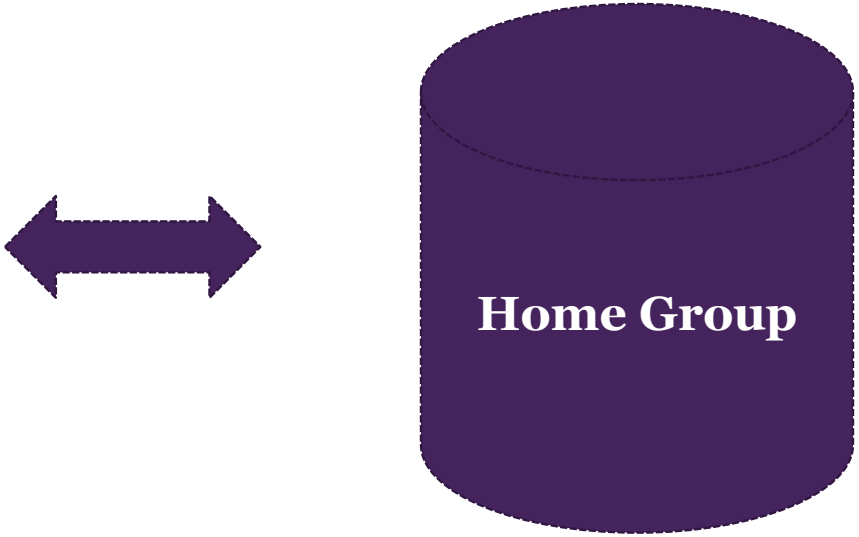
Team study
- Individual test
- Team Recognition

JIGSAW

EXPERT GROUPS



When students return to home group
the expert members share and develop together to create a project that reflects the unit summary



Students are assigned to work in main idea or focus groups related to the content. In this group the goal is to discover and record information about the specific topic -- becoming an "expert" . Then they will share that

Supports within Cooperative Learning

Computer aided instruction - use of computers to teach academic skills and to promote communication and language development and skills

Peer Mediated Instruction and Intervention - peers are systematically taught ways of engaging learners with ASD in social interactions in both teacher-directed and learner-initiated activities

Reinforcement - Positive reinforcement refers to the presentation of a reinforcer after a learner uses a target skill/behavior

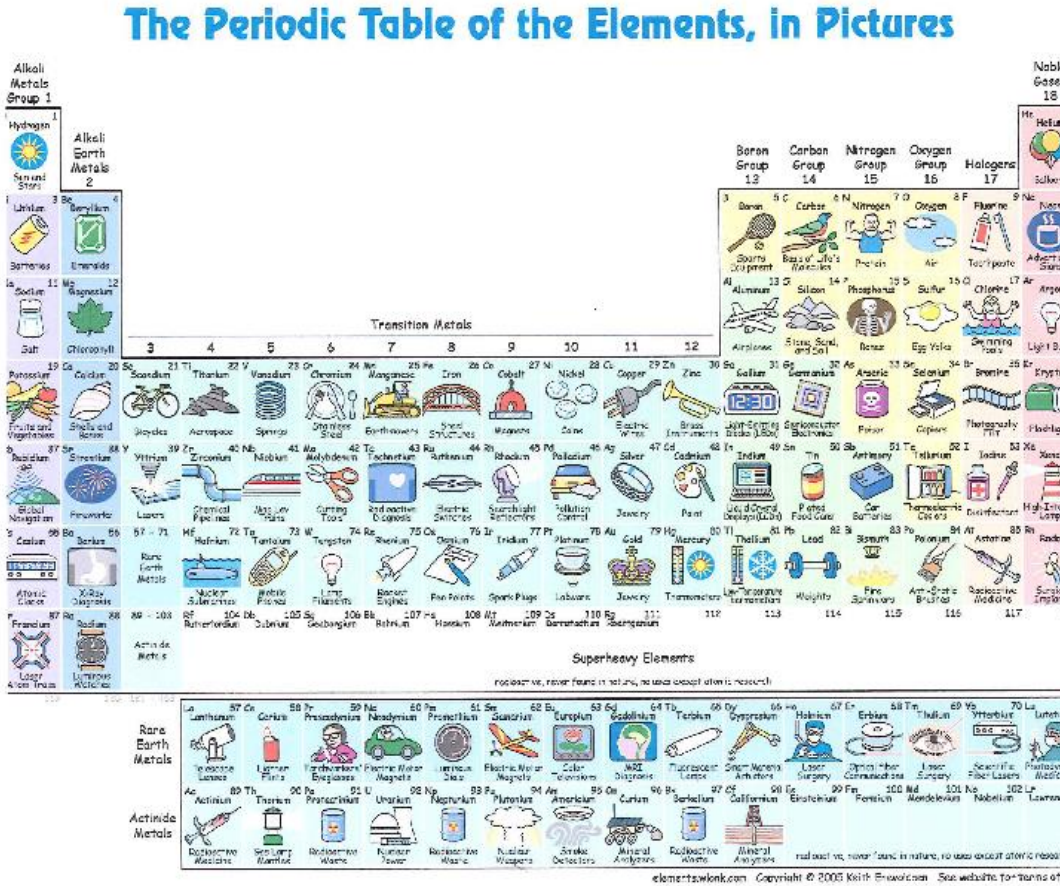
Self-management - taught to discriminate between appropriate and inappropriate behaviors, accurately monitor and record their own behaviors, and reward themselves for behaving appropriately

Supports within Cooperative Learning

Task analysis - process of breaking a skill into smaller, more manageable steps

Visual supports – any tool visually represented, such as pictures, written words, objects within the environment, arrangement of the environment or visual boundaries, schedules, maps, labels, organization systems, timelines, and scripts

Materials Adaptation



Name_____

Number_____

1. Locate the following pictures and highlight them on the periodic table, then write the name and symbol for of each element.

1. balloons _____
2. trumpet(horn) _____
3. sun _____
4. clouds and sky _____
5. a weight - dumbbell _____
6. thermometer _____
7. bulldozer _____

elements.wlonk.com

Examples

Asking a Question

Sometimes I have questions during science class.

I might be wondering about group work or maybe I just have a question about life.

When I ask questions, I try to get the person's attention by making eye contact and saying his or her name. I try to speak loud enough for people to hear me.

If I mumble or speak too softly, my question may not be heard by people.

Sometimes when I ask a question, people may not answer me. It might be that they did not hear me.

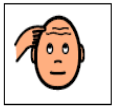
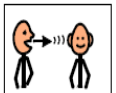
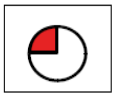
It is okay to ask questions. New questions are better than questions that have been asked and answered many times.

If there is something I don't know, I can ask a question and I will learn the answer. Sometimes I might not like the answer. Many people ask questions and get answers they do not like. Sometimes I will like the answer.

Questions are important. Without questions we could not have answers. And answers, whether we like them or not, can be quite helpful.

NAME:

STUDENT SELF-EVALUATION FORM FOR GROUP WORK

	I followed directions.	yes	no
	I used thinking skills.	yes	no
	I listened to others' ideas	yes	no
	I said, "good job" or "good idea."	yes	no
	I shared my ideas.	yes	no
	I helped to solve problems.	yes	no
	I did my part to help the group.	yes	no

by Amy Jones, Nov 2011, Mapleshade School.

Teamwork

Co-Teaching Approach	Class Design	Description
One Teach/One Support	Whole class 	One teacher leads instruction in front of the class while the other provides purposeful support (e.g. classroom management, setting up labs). Both are actively engaged.
Team teaching	Whole class 	Both teachers work together in providing instruction at head of class. Examples might be role-playing, modeling note-taking, or debates.
Parallel teaching	Regrouping 	The class is split in half in order to reduce student: teacher ratio. Each teacher provides instruction which can occur in the same or different setting with same or different content present in the same of different ways.

Co-Teaching Approaches	Class Design	Description
Station teaching	Regrouping 	Three or more groups of students rotate through centers or stations. Teachers either facilitate at centers or circulate among all centers.
Alternative teaching	Regrouping 	One teacher works with a larger group of students while the other provides a smaller group reteaching or enrichment. New instruction is not presented to larger group during this time and smaller group rejoins when finished.

Progress Monitoring to Support Science Learning

Common Core Standards

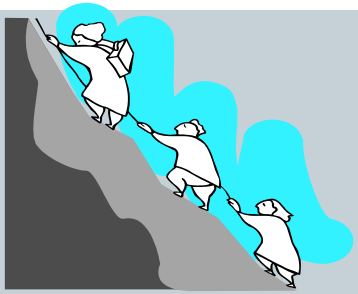
Progress monitoring is a formative process to assess student academic performance and evaluate the effectiveness of instruction.

(National Center on Response to Intervention [NCRTI], 2010).

Individualized Targets

(2012) TEC, Vol.44, No. 6, pp66-72.

Progress Monitoring



Challenge

Variable content → Variable probes

Solution

Key word vocabulary

Creating Key Word Vocabulary Probes

1. Identify key words by unit and cross-referencing with state standards and end of course exams.
   - May be available as electronic files from text publisher
   - Can be done over course of year in prep for next year
   - Collaborate with other teachers to divide and share probes
2. Create fill-in-the-blank database.
3. Randomly select 15-20 questions from database.

The Science Key Vocabulary Assessment (SKeVA) is a free online progress monitoring system with over 2,000 validated items.

Progress Monitoring Example

Science Key Vocabulary Assessment (SKeVA)

demostudent2 EXIT Return to Home Page March 23, 200

SKeVA: Science Key Vocabulary Assessment

demo student2,

1. Please read the **questions** and **answer choices** carefully,
2. Pick the best **keyword** choice, and type the letter in the blank that correctly answers the question. Each answer may be used only once,
3. When you have answered a group of questions on each page, please hit the button labeled **SAVE and CONTINUE**,
4. When you have answered the last group of the questions, please hit the button labeled **FINISH** to complete the test and see your score.

QUESTIONS

1. Natural processes that form, change, break down, and re-form rocks over time is called the _____ .

2. _____ is a type of rock that is a renewable resource because new rock is made when magma and lava cool.

3. Weathering and _____ does not occur on the Moon because water and wind are not found on the Moon to carry sediments away.

4. _____ forms when pieces of rocks, plants, and other loose material are cemented together in the Earth.

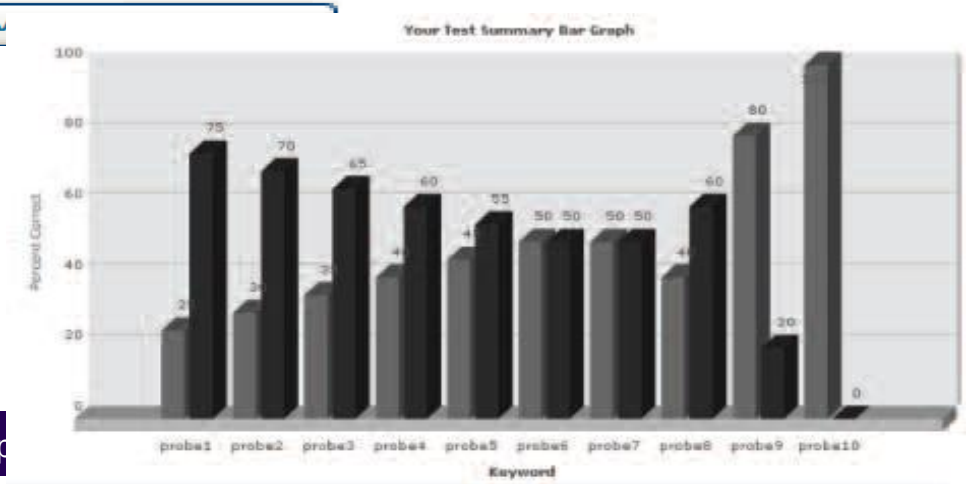
5. _____ is a process that breaks down rocks.

KEYWORDS

A. erosion
B. weathering
C. sedimentary rock
D. rock cycle
E. mantle
F. igneous rock

SAV

Test summary bar graph example



Provide Meaningful Outcomes

Teachers need to know how to:

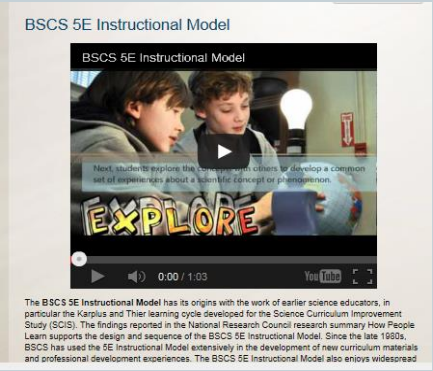
- Provide functional experiences.
- Integrate content through inquiry approaches.
- Incorporate standards through authentic application.
- Introduce science content throughout the functional curriculum

A balanced curriculum promotes meaningful outcomes and a higher quality of life post-school.

(Ayers et al., 2011).

Science Resources for Educators

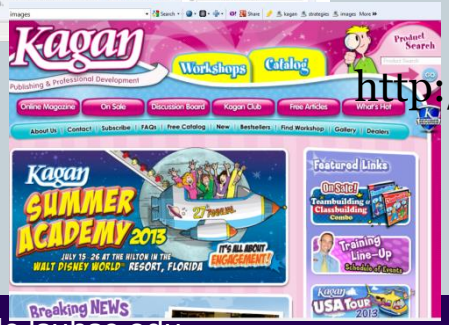
http://www.pbs.org/teachers/stem/



http://BSCS.org

http://skeva.tamu.edu/index.php

http://artofteachingscience.org



http://www.kaganonline.com/index.php

QUESTIONS?

lasard@lsuhsc.edu