Response to Intervention: Making Science Accessible to All Learners

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Science is on the Rise

- Between the years of 2000 and 2016 it is estimated that….

- the 2 areas that will have the greatest demand for professionals are
  1.) Healthcare
  2.) Clean Energy Production and Environmental Protection

- Executive Office of the President’s Council of Economic Advisors, 2009
Job Demand

- The growth of healthcare professionals will increase by 48%
- The growth of environmental professions will increase by 52%
- All other professions are anticipating an average of 13% growth
What kind of jobs can we expect to see in the future?

- Zero Energy Architects
- Digital Detectives
- Stem Cell Engineers
- Health Robotics Engineers
- Genetic Engineers
- Combined Heat and Power Mechanics
- ???
Will our students be prepared?
National Data

- National Assessment of Educational Progress

Science Skills Scores compared:
1996-2000-2005
- 4th graders increased
- 8th graders showed no change
- 12th graders decreased
The State of Science in Texas

What does the data say?
### Fifth Grade Mastery by Objective - 2008

<table>
<thead>
<tr>
<th>Objective</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1: Nature of Science</td>
<td>90%</td>
</tr>
<tr>
<td>Objective 2: Life Science</td>
<td>90%</td>
</tr>
<tr>
<td>Objective 3: Physical Science</td>
<td>87%</td>
</tr>
<tr>
<td>Objective 4: Earth Science</td>
<td>75%</td>
</tr>
</tbody>
</table>
## Data by Objective- Middle

<table>
<thead>
<tr>
<th>Objective by Objective</th>
<th>8th Grade Mastery by Objective- 2008</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1: Nature of Science</td>
<td>77%</td>
</tr>
<tr>
<td>Objective 2: Life Science</td>
<td>75%</td>
</tr>
<tr>
<td>Objective 3: Matter</td>
<td>72%</td>
</tr>
<tr>
<td>Objective 4: Forces, Motion &amp; Energy</td>
<td>78%</td>
</tr>
<tr>
<td>Objective 5: Earth and Space Science</td>
<td>68%</td>
</tr>
</tbody>
</table>
## Data by Objective - High

<table>
<thead>
<tr>
<th>Objective</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Objective 1: Nature of Science</td>
<td>75%</td>
</tr>
<tr>
<td>Objective 2: Organization of Living Systems</td>
<td>68%</td>
</tr>
<tr>
<td>Objective 3: Interdependence of Organisms and the Environment</td>
<td>67%</td>
</tr>
<tr>
<td>Objective 4: Structure and Properties of Matter</td>
<td>61%</td>
</tr>
<tr>
<td>Objective 5: Motion, Force and Energy</td>
<td>72%</td>
</tr>
</tbody>
</table>
Thinking about the Future

- How do we prepare our students to pass TAKS?
- How do we prepare our students to graduate from high school?
- How do we prepare our students to get to and through college?
- How do we prepare our students to be successful professionals?
We are not reaching all of our students.

What do we do?
RtI Research

- UT, Austin-Vaughn Gross Center for Reading and Language Arts
- Intervention program for early readers to prevent learning difficulties in later grades- research in grades K-3
- Three Tier Model
Response to Intervention Model

- **TIII:** Intensive Individual Instruction
- **TII:** Supplemental Instruction
- **TI:** Core Instruction
Tier Descriptions

- Tier I
  - all students
  - core curriculum
  - progress monitoring
  - ongoing professional development

- Tier II
  - students not making adequate progress in Tier I
  - small group
  - students that “catch up” move back to Tier I
  - students that continue to struggle are moved to Tier III

- Tier III
  - small group or individual
  - longer periods of instruction
RtI Controversy

- Small research base but universal implementation
- No consistent model
- Overrepresentation/tracking
- Meeting students needs/Teacher preparation
- TAKS-based? What is our goal?
- What does RTI look like in other subjects?
So.....

Where do we start?
Tier I

Where are we at with our core instruction?
Success in Science- Tier I

- 5 main foci

1.) Effective Lesson Planning
2.) Engaging Students
3.) Making Content Comprehensible for All Learners
4.) Developing Academic Language
5.) Assessment
1.) Effective Lesson Planning
The Importance of Planning

The Skillful Teacher-Saphier & Gower
The Skillful Teacher-
Saphier & Gower

“A clear objective articulated by a teacher in terms of student mastery is the indispensable anchor of good daily lesson planning. The quality of one’s thinking about objectives during planning directly accounts for the effectiveness of student learning experiences.”
Using the TEKS

1.) Know your TEKS- don’t rely on textbooks, supplemental materials (Texas Standards)

2.) Plan with the END in mind.
   - What concepts do you want your students to understand?
   - What academic language are you hoping to develop?
   - What connections do you want to make past learning/experiences?
   - What tools do you want them to be able to use? (vocabulary, measurement tools, scientific skills)
   - What future concepts do you want them to be prepared for?

3.) Essential Questions-Lesson Planning

4.) Assessment
2.) Engaging Students: The First “E”
Strategies that Work:

- Audio and Visual Media
- Podcasts
- Relevant Problem Solving
- Music
- Games
- Word Splashes
- Anticipation Guides
- Demonstrations
- Read Aloud
3.) Making Content Comprehensible
9 Strategies Most Likely to Improve Student Achievement

- Identifying similarities and differences
- Summarizing and note taking
- Reinforcing effort and providing recognition
- Homework and Practice
- Nonlinguistic Representations
- Cooperative Learning
- Setting Objectives and Providing Feedback
- Generating and Testing Hypotheses
- Cues, Questions and Advance Organizers

Classrooms that Work - Marzano, Pickering and Pollock
Professor Herman paused when he heard that unmistakable thud -- another brain had imploded.
Academic Achievement

- Innate/Fixed Level of Intelligence
- Effort and Hard Work
Effective Science Instruction Cycle

Motivation is the Driving Force

Elicit Prior Understanding: Identify Initial Ideas

Intellectual Engagement: Experience to Confront Initial Ideas

Use of Evidence: Formulate New Ideas Based on Evidence

Sense-Making: Reflect on How Ideas have Evolved

Horizon Research, 2008
Comparing Instructional Strategies

**Less Effective**
- Teacher Lead
- Students Work Independently
- Memorization
- Text Driven Lessons
- Classroom is Quiet
- Pull Out
Modern

More Effective

- Student Lead
- Students Work Cooperatively
- Internalization
- Inquiry Driven Lessons
- Students are Talking
- Sheltered Instruction
Strategies that Work:

- Visuals
- Hands-On
- Kinesthetic Learning
- Varied Interactions:
  - Whole Group
  - Small Group
  - Partners
- Multiple Presentations
- Frequent Formative Assessment
Engagement=Motivation

- How can we engage everyone?
- Differentiation
- Enrichment Opportunities
- STEM programs
- Community Involvement
- Field Lessons
- Contests
- Integration
4.) Developing Academic Language
Strategies that Work:

- Graphic Organizers
- Foldables
- Cooperative Learning
- Class Discussions
- Journaling
- Word Walls
- Vocabulary Games
- Literature Integration
Word Walls Everywhere!
5.) Assessment
Strategies that Work:

- Data Driven Instruction
- Frequent Formative Assessments
- Summative Assessments used in Planning Process
- Connecting 3-D Experiences to 2-D Test Questions
Helpful Hints:

- Develop a Spiraled Curriculum—homework, stations, mini-lessons
- Progress Monitoring—how do you know where your students are at?
- Integrate reading and math skills into your weekly routines and lessons
Tier II

- Small Group Review
- Science Skill Stations with Teacher Support
- Group Problem Solving with Teacher Observation
- Before or After School Tutoring
- Enrichment Classes
Tier III

- Inclusion Teacher Support
- Second Instructional Period
  - Front Loading New Material
  - Reviewing Material

*not pull-out during science instruction!!!
How is RtI for Science different?

- Not based on precise quantitative data
  - Reading: fluency and comprehension
  - Math: fluency, computation and problem solving
  - Science: conceptual understanding
    (vocabulary is not enough)
How can you assess students in science?

- Multiple Choice
- Short Answer
- Essay
- Journal Entries
- Task Performance
- Anecdotal Records
- Model Eliciting Activities
- Small Group Observations
- Student Interviews
BEWARE!!!!

- Suggested Science RTI
- Packaged Science Programs
- Emphasis on rote memorization and not experiential learning and internalization

So, how do we support all learners in science?
How can administrators impact science achievement?

- Dedicate Time
- Clear Objectives
- Accountability at ALL Grade Levels
- Assessment Training
- Strategies for ELLs
- Support Teacher Learning
- Promote a Positive Attitude
- Join the Texas Regional Collaboratives
Questions?