

## Retention Strategies

### Observations/Evidence:

- Probability lesson included summary/reflection
- "Do Now" used in every class to make connections
- Students applied vocabulary as soon as it was defined
- Terminology visible in all classes
- Use of technology incorporated into all classes
- Pythagorean Theorem – good initial question to define a P.T.; reinforcing vocabulary "when does the theorem not work?"; Real – life example: ladder and house; Aim was posted on the board; Responses were positive – good feedback; safe environment for student participation
- Quadrilaterals – real world connection with family tree and quadrilateral tree; making connections to other disciplines, i.e. Social Studies
- Scientific Notation – exposure to Regent's prep online; use of Frayer Model; closure activity re-capped learning

### Suggestions:

- Have students defend their findings and explain their processes whether answers are right or wrong.
- Continue to build/strengthen students teaching one another
- Make sure to "close" every lesson (maybe use journaling, think-pair-share to involve everyone)
- Encourage students' posing of problems rather than it always being the responsibility of the teacher
- Ask more probing questions
- Pythagorean Theorem - Make sure transition from P.T. to Activity 2 (maps) effectively reinforces P.T.; check for understanding before moving to independent work
- Quadrilaterals – include a closure activity (perhaps another full group "quiz" on the SmartBoard, Venn diagram, Exit cards – identify a type of each shape in the room
- Scientific Notation – consider use of manipulatives to bring in real-world examples to make connections with students (i.e. H1N1 virus, national debt, distance to stars, age of earth); challenge students to higher level of Bloom's Taxonomy (go deeper)

### Notes/Questions:

## Vocabulary/Math Literacy

### Observations/Evidence:

### Suggestions:

<ul style="list-style-type: none"> <li>• Vocabulary building strategies in all classes: word walls, vocabulary journals</li> <li>• Students break words into parts to find meaning!</li> <li>• Geometry teacher was very consistent about using proper vocabulary and correcting students when they did not</li> <li>• Pythagorean Theorem – introduced new V.W.; students participating to write the word; used terms and encouraged students to use the terms; identified/referenced previously learned terms; explanation of why <math>a^2 + b^2 = b^2 + a^2</math></li> <li>• Quadrilaterals – strong warm-up to review properties/definitions of each shape (access prior knowledge); interactive activity reinforced vocabulary</li> <li>• Scientific Notation – use of SmartBoard and Frayer Model to define with characteristics and examples; connected exponents to today’s lesson</li> </ul>	<ul style="list-style-type: none"> <li>• Use and vocabulary <u>within</u> activities and with a deeper understanding (e.g. ask if a rhombus is a square)</li> <li>• In Geometry, have students sketch picture to understand and retain</li> <li>• Try having students formulate their own definitions in groups and then assess them as a class by finding counter-examples</li> <li>• Look for opportunities to explain how math syntax and logic are unique and students must learn to speak the language of the discipline of math (e.g. it seems counter-intuitive to call the <u>actual</u> outcome the <u>experimental probability</u>)</li> <li>• Pythagorean Theorem – consider working more intentionally with the word wall</li> <li>• Quadrilaterals – suggest closure to reinforce vocabulary once again</li> <li>• Scientific Notation – reinforce vocabulary by re-visiting word wall and connect with real-world examples; consider an alternate form of the Frayer Model to include sections for: definitions/characteristics, “In my own words”, uses, and pictorial representation</li> </ul>
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<b>Notes/Questions:</b>	
<ul style="list-style-type: none"> <li>• Could the family tree analogy be stretched to explain why it’s important for members of the same family to have different names?</li> <li>• What outcomes might you expect if students interacted more with the word walls?</li> </ul>	

<b>Student Engagement</b>	
<b>Observations/Evidence:</b> <ul style="list-style-type: none"> <li>• Students enjoyed working together and nearly all students were willing to contribute</li> <li>• All lessons made connections to real-world situations and student interests</li> <li>• Evidence of good/growing staff expertise with SmartBoards – possibilities are endless</li> </ul>	<b>Suggestions:</b> <ul style="list-style-type: none"> <li>• Encourage students to make predictions (e.g. what do you think will happen?)</li> <li>• When only one or two students are participating in closing discussion, try journaling or think-pair-share to increase involvement</li> <li>• Make sure the font used on the SmartBoard is</li> </ul>

<ul style="list-style-type: none"> <li>• All classes had very clear opening procedures (get notebooks, Do Now, etc.) and workshop format was evident – helps with “finding their place”</li> <li>• All students treated with respect and all answers/responses validated</li> <li>• Evidence of so many teachable moments . . . opportunities for in depth discussions of concepts were everywhere. Students asked GREAT questions!</li> <li>• Pythagorean Theorem – involved each student, good movement in classroom; high expectations – used clock as motivator; good use of SmartBoard as a tool – included student giving explanation</li> <li>• Quadrilaterals – good facilitation/checking for understanding to complete task; good use of technology; teacher knows students strengths/weaknesses; quiet music during work time; student rapport; personal connection/sharing of “self” through the family tree; continual connection between family tree and quadrilateral tree; friendly competition between groups created urgency to complete task; reference that this learning will be <u>used</u> in the test tomorrow</li> <li>• Scientific Notation – good use of SmartBoard during demonstration of Frayer Model; students enjoyed pop-up answers at the end</li> </ul>	<ul style="list-style-type: none"> <li>• big enough and dark enough for all to see</li> <li>• Use real-world connections that have a clear, direct connection to the content (family tree and NYC map wasn’t a perfect fit for student understanding)</li> <li>• Probability Lesson – challenge students by: asking more probing questions; greater focus on fraction/percentage relationship; create an in-class simulation using probability (i.e. allow students to place fictional wagers)</li> <li>• Probability &amp; Quadrilateral Lessons – talk about how the SmartBoard works by asking, “How does the spinner/dice on screen act like a real spinner/dice?” (They use the same rules of theoretical probability we do). “How/why does the trapezoid stay a trapezoid when it’s stretched?” (bases remain parallel)</li> <li>• Look for ways to collaborate more to share ideas and fully develop lessons around real-world applications</li> <li>• Pythagorean Theorem – make stronger connections between 1<sup>st</sup> and 2<sup>nd</sup> activity with stated Aim (not sure about purpose of 2<sup>nd</sup> activity)</li> <li>• Quadrilaterals – assign each group a branch of the tree to report on similarities/differences (instead of teacher leading); ask more specific questions during lesson closure that readdresses the Aim of the day</li> <li>• Scientific Notation – explore effective use of groups (collaborative learning, pair-share, etc.); increase pace – lesson seemed to move very slowly. Real-world connections and putting up 4 problems at a time might spark conversation.</li> </ul>
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**Notes/Questions:**

- Would the probability lesson have been stronger using concrete models rather than the SmartBoard?
- What do you think would happen if the first five minutes of class were spent making connections with students and self, students and subject, student and students, self and subject?
- How do you assess/measure student success/understanding at times when all students did not participate in open discussion nor be asked to respond to teacher’s questions?
- Pythagorean Theorem – needed explanation on why 27 was an acceptable answer when correct mathematical answer was 26.92
- Quadrilaterals – Great lesson, awesome intro, engaging middle – closing had lots of potential (needs some work)

## Problem Solving

### Observations/Evidence:

- Problem solving going on in each classroom – students asked to apply what they've learned in another form
- Saw students in all classes share how they got results and there was generally an openness to different methods
- Saw multi-step problems/activities in classes (Pythagorean Theorem and Quadrilaterals) and students were engaged in finding solutions in all
- Quadrilaterals – good scaffolding “3 branches to start” – enough of a clue to get them started but still had to solve problem. Teacher knew when students were guessing – didn't respond
- Quadrilaterals – good transfer of a problem-solving process to a non-related situation

### Suggestions:

- Pythagorean Theorem – great real-world situations though suggest more set up to make more real (ex. Your construction company has 2 ladders – a 30 ft. and a 40 ft. The 30 ft. ladder is already in the truck – do you need to take the time and energy to add the 40 ft. ladder?)
- Try implementing some routines that foster independence – for example, instead of asking “Is this right?”, consider “I'm confident about this answer because . . .”
- Problems used did not always clearly demonstrate the skill or weren't well connected to the set up. Consider finding resources on line or via print materials rather than create your own
- Don't make problems/questioning easier until students are answering (ex. What is  $180 - 75$ ?). Provide support by helping make connections – “What do you know/what connections can you make?”
- Real world questions that come from students would benefit problem solving, engagement, retention, and vocabulary. Students need to learn to use the language of Math.
- Allow students more “think time” and let them walk out of class not necessarily knowing the answer. Demonstrate how to ask the right questions to reach a viable solutions – use conundrums.
- Guide students to talk about meta-cognition. Rather than, “now on to Part 2” you might ask, “Is there a next step?”
- Make problem solving techniques more explicit/apparent (ex. Have all students sketch the image they have of types of quadrilaterals and then match to definitions. Have them first estimate, then sketch ladder problem and compare sketches to see which elements are helpful
- Suggest displaying a problem solving process (steps) in classrooms for students to engage with frequently and review often
- Scientific Notation – student centered activity exploring the half-life of the H1N1 virus or the Hubble telescope's pictures would lend itself to

	rich problem solving opportunities
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<b>Notes:</b>